

PUBLIC WORKS

Nov.
1959

CITY, COUNTY AND STATE

**Why Wichita Is Building
A Trickling Filter Plant
3½ MILES DOWNSTREAM
from Primary Units**
page 83

**How the Traffic Engineer
Works to
REDUCE ACCIDENTS**
page 87

**Factors in the Selection
of Municipal
REFUSE INCINERATORS**
page 99

**The Design of Prestressed
CONCRETE I-BEAMS**
page 106

**Waterworks Move Toward
AUTOMATION**
page 114

**AND MANY OTHER
IMPORTANT ARTICLES
SEE PAGE 5**



Buy on **FACTS** that benefit **YOU** *...and you'll buy the* **GALION 160 Grader!**



Write for literature.

THE GALION IRON WORKS & MFG. CO.

General and Export Offices

Galion, Ohio, U.S.A.

Cable Address—GALIONIRON, Galion, Ohio

STANDARD EQUIPMENT INCLUDES . . .

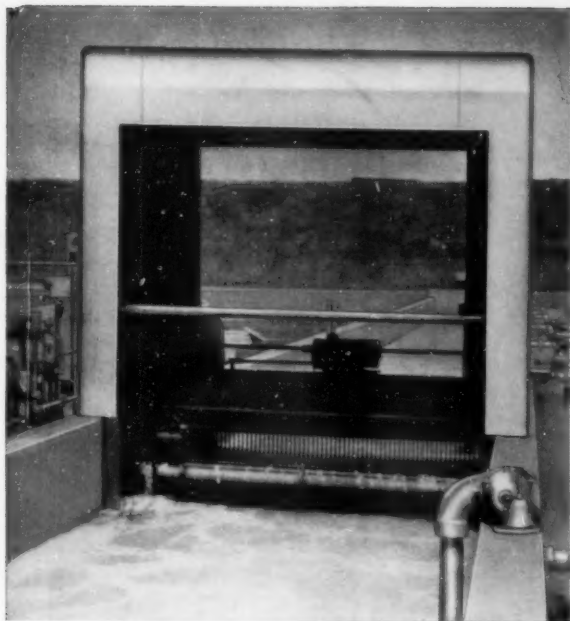
- ☐ 160 hp direct-starting diesel engine.
- ☐ Power balanced to weight—rear end 20,200 lbs., front end 8,320 lbs., provides the utmost in tractive effort and front end stability.
- ☐ Combination manual with hydraulic power steering.
- ☐ Four-wheel hydraulic brakes.
- ☐ Tires 14.00 x 24, 10 ply, same size front and rear—interchangeable.
- ☐ Hydraulic power shift moldboard (13' x 29" x 3/4").
- ☐ Front wheel spindles (3 3/8" x 2") designed for large tires.
- ☐ Positive-acting leaning front wheels. Simple maintenance—only two grease fittings to service.
- ☐ Full hydraulic control.
- ☐ Eight-unit control manifold for convenient installation of extra attachments.
- ☐ Two-stick shift mechanism for the 6-speed constant-mesh transmission.
- ☐ Full-floating rear axles.
- ☐ Extra-heavy frame, weight per ft. 134 lbs.

Check the features included as **STANDARD** equipment on the grader you may have been thinking of buying. Then ask yourself—"Which offers me the **MOST** for my money?—GALION Model 160."

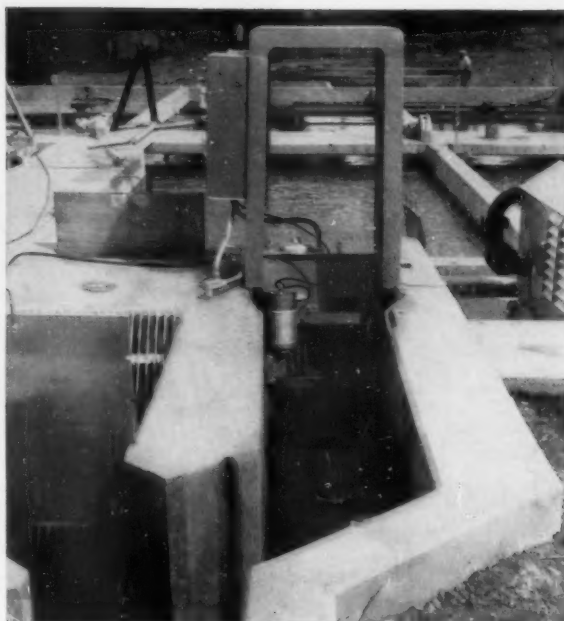
GALION
 ESTABLISHED 1907



MOTOR GRADERS & ROLLERS

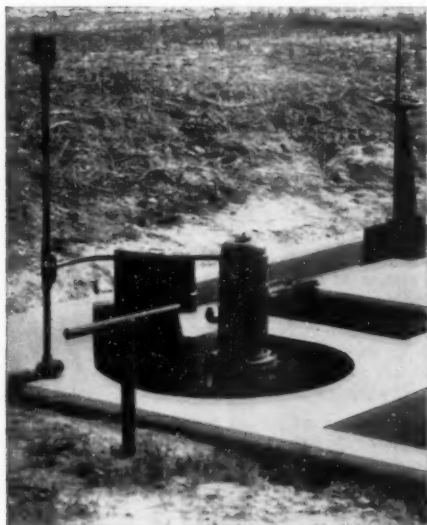


Model "A" BARMINUTOR® Screening and Comminuting Machine . . . for use in rectangular channel sections 4 to 12 feet wide . . . sized for flows of 10 MGD and upwards.



Model "B" BARMINUTOR® Screening and Comminuting Machine . . . for use in rectangular channel sections 1 to 3 feet wide . . . sized for flows of .09 to 15 MGD.

"from Chicago" Lower Cost, More Flexible Comminution with BARMINUTOR® Comminuting Machines



"Chicago" COMMUNUTOR* Screening and Comminuting Machine . . . for use in hydraulically designed feeder basin . . . sized for flows of .175 to 25 MGD per machine.

*Trademark

A Development of More Than 25 Years Successful Comminutor Experience

The BARMINUTOR® Screening and Comminuting Machine provides continuous, complete, automatic comminution . . . at lower operating and maintenance cost than any similar device available today.

The BARMINUTOR® was developed to provide greater flexibility and wide application of comminution . . . developed from the original "Chicago" COMMUNUTOR, proven highly successful in thousands of installations.

BARMINUTOR® Screening and Comminuting Machines eliminate unsightliness, nuisance and odor by continuously and automatically screening and cutting coarse sewage material without removal from the flow. Power requirements are lower than that required for mechanically raised screens and grinders. Manual attention is needed only for periodic inspection and lubrication.

*Complete details are available from Chicago Pump Company
Distributors located in most principal cities.*



Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Chicago Pump Company

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS
Copyright 1958—Chicago Pump Company



NO. 12 WORKS in rough going at a steady pace!

Onondaga County Highway Department, Jamesville, New York, relies on Cat No. 12 Motor Graders for all its grading work. Here's one of them on a typical job—widening road from 18 to 24 feet. In 8-hour days, its scarifying and grading production averaged 380 feet a day. Stanley Bronner, who is experienced in operating most other make graders, says: "The No. 12 is far superior. It has better traction, better visibility and works in the toughest going at a steady pace."

To match your requirements, Caterpillar offers three modern, heavy-duty Motor Graders. There's the 75 HP, 20,805 lb. No. 112, or the 115 HP, 23,000 lb. No. 12. And for big jobs, the new 150 HP, 29,280 lb. Turbocharged No. 14—the most versatile big grader ever developed, recommended for everything from the roughest jobs to the finest grading. Each is designed to do more work at lower cost with less down time than any other unit in its class.

Public records from communities all over the country prove that the low total cost of Cat Motor Graders makes them the best investment for taxpayers' dollars. Get these facts, which cover yearly operation and maintenance, from your Caterpillar Dealer. See for yourself how a Cat Motor Grader is your best buy!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

4 OF THE NO. 12'S MANY FEATURES THAT PAY OFF IN LOW TOTAL COST!

Mechanical controls (standard) offer positive action, make blade adjustments precise. Powered right from the engine, they give a speed and range of blade movements that no other unit can match.

Preco Automatic Blade Control (optional) is available only on Cat Motor Graders. Now transistorized for freedom from maintenance and adjustment, it controls blade slope to an accuracy of within $\frac{1}{8}$ inch in 10 feet, regardless of position of grader or unevenness of terrain. Fine for all types of grading.

Unequalled visibility results from the No. 12's dash-mounted lift gears and low frame design. While seated, the operator has an unobstructed view of the critical areas at the front wheels, toe of blade and circle.

Exclusive oil clutch provides up to 2,000 hours without adjustment—the equivalent of about 12 months of "adjustment-free" operation.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**BUY LOW TOTAL COST—
BUY CAT MOTOR GRADERS**

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

NOVEMBER, 1959 • Volume 90, Number 11

| | |
|---|--|
| Secondary Sewage Treatment Facilities are 3½ Miles from Primary Plant 83 | Refuse Study Program: Characteristics and Quantity 125 |
| <i>Repeated expansion of the original plant at Wichita, Kansas, used up all available land, necessitating location of plant additions at another site and construction of a transmission main for settled sewage.</i> LLOYD W. WELLER | Highway Research Council of Ohio 135 |
| The Job of the Traffic Engineer—It Lasts the Lifetime of a Road 87 | Bridge and Pavement Design for Interstate Roads in Michigan 136 |
| <i>The impact of Interstate highway system construction on traffic engineering services, among generally increased responsibilities, features new work loads in signing and lighting.</i> A. J. BASILE | <i>Techniques used in designing for expressway loads.</i> HAROLD R. PUFFER AND OLAF L. STOKSTAD |
| Prestressed Concrete Standpipe 92 | A New Method for Tapping Into Sewer Lines 138 |
| <i>2.95-million gallon structure built by the slip form method at Sayreville, N. J., is the largest of its type yet constructed.</i> | Analysis of Vacant Land in the City of Chicago 139 |
| Providing Sewage Disposal for a Metropolitan Area... 94 | Special Truck Bodies Used by Cities 146 |
| <i>Phase construction, using standardized sewage treatment components, is the answer for Oakland County, Michigan.</i> HOWARD K. SCHONE | Highway Improvement Portraits Sell Proposed Projects to the Public 154 |
| Liability Insurance is a Must for County Operation ... 96 | Submersible Pumps Dewater Canal Lock 155 |
| <i>Blanket liability insurance has proved to be an effective and highly desirable protection for Douglas County, Washington.</i> PAT THOMSON | Thermoplastic Road Striping Material 155 |
| Municipal Incinerator Selection 99 | Litter Baskets Stressed in Town Clean-Up Campaign 160 |
| <i>A step-by-step analysis is made of the factors to consider in designing an incinerator to meet specific conditions in refuse handling.</i> H. G. MEISSNER | Pneumatic Handling of Dry Chemicals at a Small Water Treatment Plant 162 |
| The Design of Prestressed Concrete I-Beams 106 | Public Works Responsibilities in Emergencies 163 |
| <i>Mathematical analysis shows designers how to determine proper initial prestressing forces and provides useful shortcuts for arriving at the final answers.</i> JOHN F. McDERMOTT | <i>A plan for action and how it helped during the Kansas City Flood.</i> REED McKINLEY |
| Waterworks Move Toward Automation 114 | |
| <i>A comprehensive review of the circuits and equipment generally employed in electronic control systems, including microwave and wire line transmission using tone generators, dial interrogators, ultrasonic sensors and data logger.</i> LEO G. SANDS | |

PUBLIC WORKS DIGESTS:

| |
|---------------------------------|
| Highways and Airports 126 |
| Sewerage and Refuse 140 |
| Water Works 148 |
| Industrial Wastes 156 |

EDITORIAL DEPARTMENT

W. A. Hardenbergh, Editor
A. Prescott Folwell, Editor Emeritus
Edward B. Radie, Managing Editor
Clayton H. Billings, Helen E. Quinn,
Associate Editors
Frank Force, Alvin Jacobson,
Digest Editors
D. A. Okun, Technical Consultant
Nathaniel Pousette-Dart, Art Consultant

DEPARTMENTS AND SECTIONS

| | |
|---|-----------------------------|
| The Editor's Page 7 | Municipal Power 72 |
| Leader in Public Works .. 20 | Legal Notes 76 |
| Books in Brief 24 | APWA News Bulletins121 |
| Reviews of Catalogs 32 | Equipment News171 |
| Letters to the Editor 52 | News of Engineers177 |
| Commentary on Water and Sewage Treatment 56 | Worth Seeing179 |
| | Worth Telling180 |



Established 1896
Public Works T. M. Reg. U.S. Pat. Off.

Published Monthly by Public Works Journal Corporation, Office of Publication at Orange, Conn. Editorial and Advertising offices at 200 So. Broad St., Ridgewood, New Jersey. Subscription rates: U.S.A. and possessions, \$5.00. All other countries, \$7.00. Accepted as controlled circulation publication at Orange, Conn.



Copyright 1959 by
PUBLIC WORKS JOURNAL CORP.
200 So. Broad St., Ridgewood, N. J.

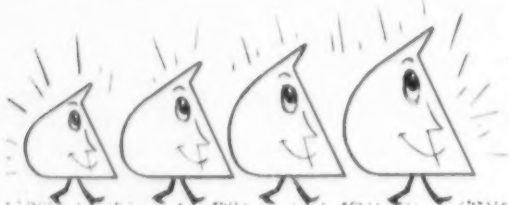
When is a 2-yd Loader Not a 2-yd Loader?

... Simply when it operates over or under carrying capacity. The right combination to peak production and longer loader life is the right size bucket on the right size loader.

That's why Allis-Chalmers offers a wide selection of buckets for each of the TL-14, TL-16 and TL-20 TRACTOLOADERS. You choose the size that's just right for the weight of materials you handle and your job operating conditions.

Some buckets are too big . . . others too small

Using a bucket that's too big for the material you handle can cause excessive repairs and downtime . . . using one that's too small costs you money because you're not getting all you can out of your loader. That's why you should select your bucket/loader by carry capacity. For example, with the TL-20 which has a 9,000-lb carry capacity, you could use a 3-yd bucket in materials that weigh 3,000 lb. You could use a 5-yd bucket with materials that weigh 1,800 lb.



Fit the bucket to the job

Whether you're working good, level terrain, swampy ground or hilly country, there's a right loader and bucket combination for your material needs . . . your operating conditions. Choose from 17 bucket/loader combinations.

BOTH loader and bucket have to be tough

... or the most efficient selecting in the world won't help! That's why Allis-Chalmers offers such outstanding features as extra-high spill guards . . . double-bottom bucket and replaceable wear plates—why TRACTOLOADER axles are pin-connected directly to the frame with 2-inch-diameter steel pins instead of the usual U-bolt method. There is no rolling or shift-

ing under load—no bolts to work loose, no mounting plates to warp out of shape.

Your Allis-Chalmers construction machinery dealer can assure you longer loader life . . . more consistent production year after year than anyone else. His products are by-products of experience—backed by first-line quality parts and good service.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN



move ahead with **ALLIS-CHALMERS**
...power for a growing world





THE EDITOR'S

POINT OF VIEW

—Even if Nothing Happens

EVEN IF there is no war, even if nothing happens, any municipality of 50,000 or over needs a Civil Defense Corps. So says Eddy S. Brandt, Director of Civil Defense for Evanston, Ill., in a letter to the Editor, and he is so right. Such an organization should be ready for action if occasion arises but the citizens should not be asked to go through fake motions in time of calm and peace. There should be a general plan and each one should know just where they fit into this plan.

In Evanston there are over 800 volunteers, organized in 17 divisions; equipment worth \$90,000 is ready to be used in time of war or natural disaster. Even the drugstores are organized to know what to do if the hospitals are filled. Most of the CD divisions correspond to the city departments and many city officials are in the Civil Defense Corps.

Such wise planning provides an organization composed of citizens who are prepared to help. They can select the phase of work in which they prefer to serve under such conditions. Civil Defense is insurance for a city and assurance of civic interest as well.

Politics and Water Utility Management Do Not Mix

THE AWWA is to be applauded for reconsidering Convention plans at a city where it appears that politics has cost the services of an outstanding water works engineer. Engineers have been notoriously, often shamelessly, lax in the past in supporting each other in cases such as this one. It is time this attitude changed. We hope the AWWA reconsiders seriously enough to hold its meeting in another city.

Potential Values in Municipal Refuse Are Difficult to Recover

THE PRODUCTION of municipal refuse averages about two and a half pounds per day. With an average Btu content of 8000 per pound, about 5,000 of which are potentially recoverable, the theoretical heat value per person per day is 12,500 Btu. A population of 20,000 would produce daily the equivalent of the heat value of around 1700 gallons of fuel oil. At current price levels in the east coast area this represents roughly \$250 per day.

It is understandably difficult to find a market for this heat, which is usually available in the form of steam. Heating of public buildings is one potential outlet; industry is another. An incinerator can convert the refuse into heat. Possibly cities have been lax in not utilizing these values for heating municipal garages or other public buildings, even though planning to do so may involve new approaches to location of either or both incinerator or service buildings.

Now a Global Program for Better Water Supply

THE ASSEMBLY of the World Health Organization has adopted a program designed to provide better water supplies in all areas of the world, believing that greater progress in health and well-being can be accomplished through adequate and safe water supplies than by any other means. It points out also that such installations are normally self-liquidating in that revenues from water sales will return all or a substantial part of the construction cost. Revolving funds, provided by the respective governments or from other sources, were among the methods recommended for financing.

It is gratifying to note the widening recognition of the need for more and better water supplies throughout the world. Leading water works men in this country have recently united in a program for needed water improvements. Now that the effort is to be extended to world-wide proportions, the beneficial returns will be even greater.

Specifications Can Become Obsolete As Well As Equipment

TOO MANY specifications now in use are based on methods, equipment and procedures of a decade or more ago. In the meantime, new ideas in equipment and standards have been developed which could give better results at lower cost. But instead of these advances producing a benefit to all concerned, they are too often a burden on the developer. Even though performance is superior, it is often difficult to market the new designs simply because they do not conform to ideas and requirements of the past.

Old ideas provide an even greater storage problem than do old records; in the case of records, new ones are being added constantly. Old ideas are too often hostile to the addition of anything new.

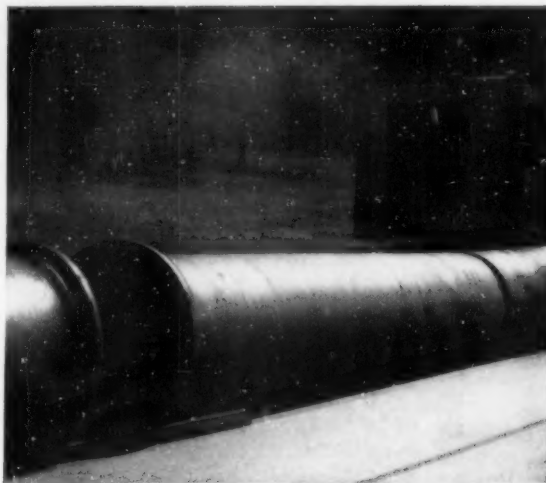
"I PREFER CAST IRON PIPE TO ANY

Recently a questionnaire was mailed to water utility managers all over the U.S.A. One question asked was: *What kind of pipe do you prefer and why?* With 42 states heard from, the vote is overwhelmingly in favor of cast iron! Here are typical comments:



"Our main system is entirely cast iron. It holds up good in 'hot' soil conditions and will not rust out. We are nearing the century mark on some of it, and it gives no trouble."

—Kansas



"Strength, resistance to corrosion . . . economical first cost, low maintenance and operating cost, good flow characteristics."

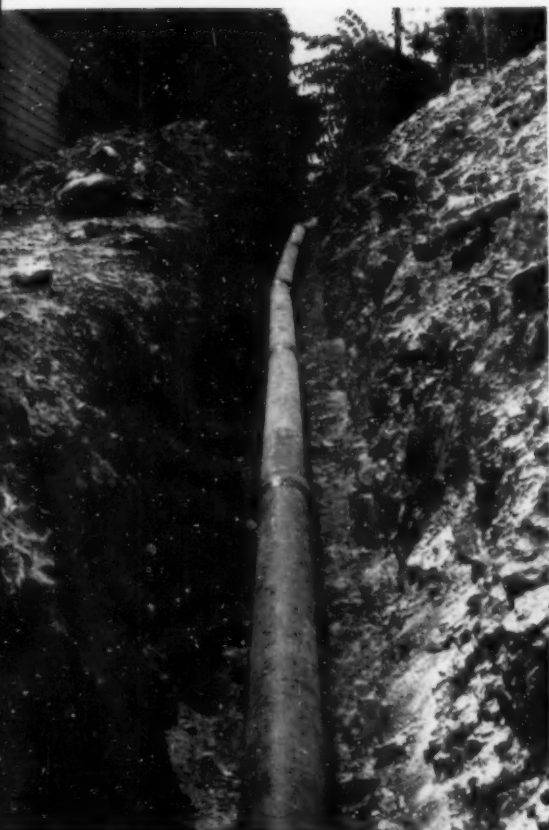
—North Carolina

"Long life—strength—ease of tapping. We are located, as a city, over old mine workings, and subsidence of earth causes trouble on other pipe to a greater extent than on cast iron."

—Illinois



OTHER KIND"



"We have a very hilly city, pressures up to 170 p.s.i. Some of our mains are 90 years old. They were cast iron and are still giving good service."

—Iowa



"Having been used over a long period of time, it has proved its worth. Structurally safe. Easy to repair."

—California

So many good reasons...

- **LONG LIFE.** The cast iron pipe you install today will be performing economically a hundred years from now.
- **HIGH CAPACITY FLOW.** Cement-lined cast iron pipe will deliver the full-rated flow all through the years. No other pipe, size for size, can carry more water.
- **CORROSION RESISTANCE.** Long life proves it. Most water utilities are still using the first cast iron pipe they installed.
- **GREAT BEAM STRENGTH.** Cast iron pipe resists the effect of heavy traffic, shifting soils.
- **TREMENDOUS LOAD RESISTANCE.** 6" cast iron pipe (Class 150) withstands a load of nearly 9 tons per foot!
- **PRESSURE-TIGHT JOINTS.** You have a complete choice of leakproof, easy-to-assemble joints. You need a minimum of tools and work crew.
- **EASE OF TAPPING.** No tapping saddles needed. Takes threading best of all kinds of pipe.

...good reasons for you to choose

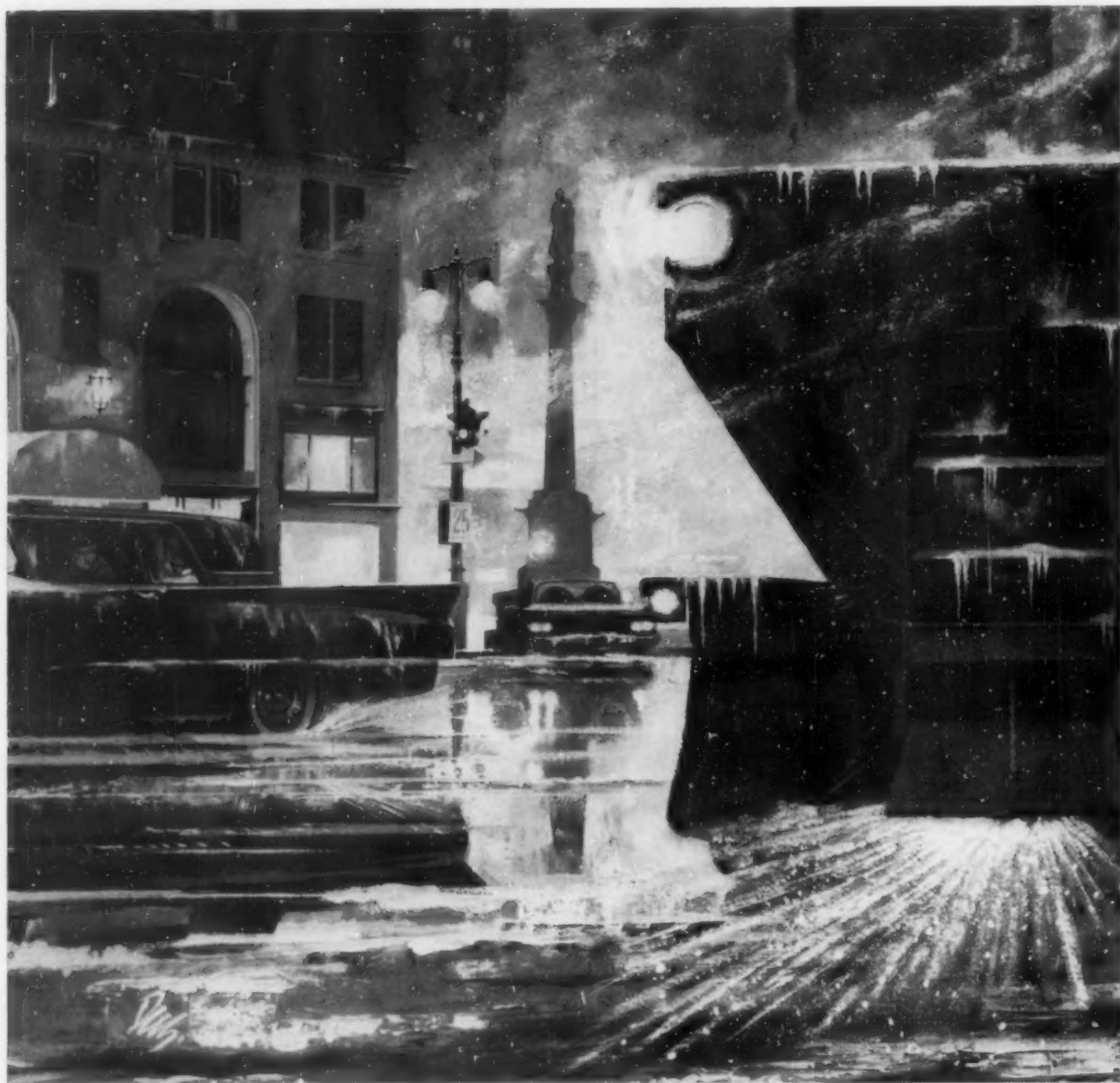


CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

Write for complete information to Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Ill.

**The lower the temperature . . .
the wiser you are to use straight
Sterling Rock Salt for ice control**



Fact: Straight Sterling Rock Salt has effective melting power at temperatures ranging from 32° F. to below zero! All that's necessary is to increase the amount of rock salt used as the temperature drops—just as you use more fuel to heat your home when it gets colder outside. For example, today many road men use about one-third more Sterling Rock Salt (straight) when the temperature falls below 20° F. This provides the bare, safe pavements which are so essential during winter storms!

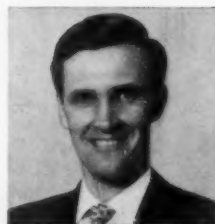
International Salt Co., Scranton, Pa. • Boston • Buffalo
Charlotte • Chicago • Cincinnati • Cleveland • Detroit • Newark
New York City • Philadelphia • Pittsburgh • St. Louis

STERLING "AUGER-ACTION" ROCK SALT
INTERNATIONAL SALT COMPANY, INC.



Lightweight, easy-handling aluminum signs go up fast. While R. J. Colpitts looks on, foreman Omer Lane easily installs this sign in only 10 minutes. Alhambra's signs are fabricated from Kaiser Aluminum blanks with reflectorized sheeting by the Mask-Off Company of Monrovia, California.

"For our money, only cost-saving aluminum signs will do!"



... says R. J. Colpitts,
Traffic Engineer,
Alhambra, California

"We like aluminum traffic control signs because we are able to get the type of sign we want—with both initial and long range savings over other materials," reports R. J. Colpitts, Traffic Engineer, Alhambra, California.

"And we know we'll save plenty on maintenance and replacement costs, as well. With rust-proof aluminum, the oxidation problem is reduced to an absolute minimum. There's no need for us to protect the edges and back surfaces of our signs.

"What's more, because aluminum signs are so easy to work with, they give our sign shop greater flexibility. We can tailor-make our sign program to suit our particular needs with little added equipment.

"No doubt about it. With us, it's aluminum traffic control signs all the way!"



THE BRIGHT STAR OF METALS



Send now for free brochure. Gives cost-saving facts and availabilities on traffic control signs made of Kaiser Aluminum. Mail coupon today.

Let us make a bid. For expert service on money-saving aluminum signs, call the manufacturer, fabricator or Kaiser Aluminum sign blank jobber near you.

Berkeley, Calif.
Hawkins-Hawkins Co., Inc.

Charlotte, Mich.
Paul H. Callender Co.

Chicago, Ill.
Bell & Gustus, Inc.

Federal Sign & Signal Corp.

Cleveland, Ohio
Osco Steel Co.

U. S. Steel Supply

Clinton, Mass.
Standard Sign & Signal Co.

Dallas, Tex.
All Quality Sign & Mfg. Co.

Elmira Heights, N. Y.
Eastern Metals of Elmira, Inc.

Evanston, Ill.
Northwest Screenprint Co.

Grand Prairie, Tex.
Sargent-Sowell, Inc.

Houston, Tex.
Western Sign & Supply Co.

Indianapolis, Ind.
Midwest Fire & Safety

Equipment Co., Inc.

Lancaster, Pa.
John I. Nissly Co.

Little Rock, Ark.
Moody Equipment & Supply Co.

Marion, Ind.
Jim Newey and Assoc.

Metairie, La.
W & A Engineers

Miami, Fla.
Biscayne Fire Equipment Co.

Minneapolis, Minn.
Lyle Signs, Inc.

Monrovia, Calif.
Mask-Off Co.

North Tonawanda, N. Y.
Northern Electric Supply Co.

Overland, Mo.
Wiegand Mfg. Co.

Peoria, Ill.
James P. Flynn Co.

Petaluma, Calif.
Kresky Signs, Inc.

Philadelphia, Pa.
Advertisers Service Co.

Rocky River, Ohio
Bowman Western Stamping Co.

Sacramento, Calif.
The Dosch Co.

St. Louis, Mo.
Parco Supplies

St. Paul, Minn.
Gopher Stamp Co.

Tacoma, Wash.
Traffic Control Signs Co.

Wichita, Kan.
Miro-Flex, Inc.

Williamsville, N. Y.
Markings, Inc.

Kaiser Aluminum & Chemical Sales, Inc.
Dept. TS-17, 1924 Broadway
Oakland 12, California

☐ Please send me your free aluminum sign brochure

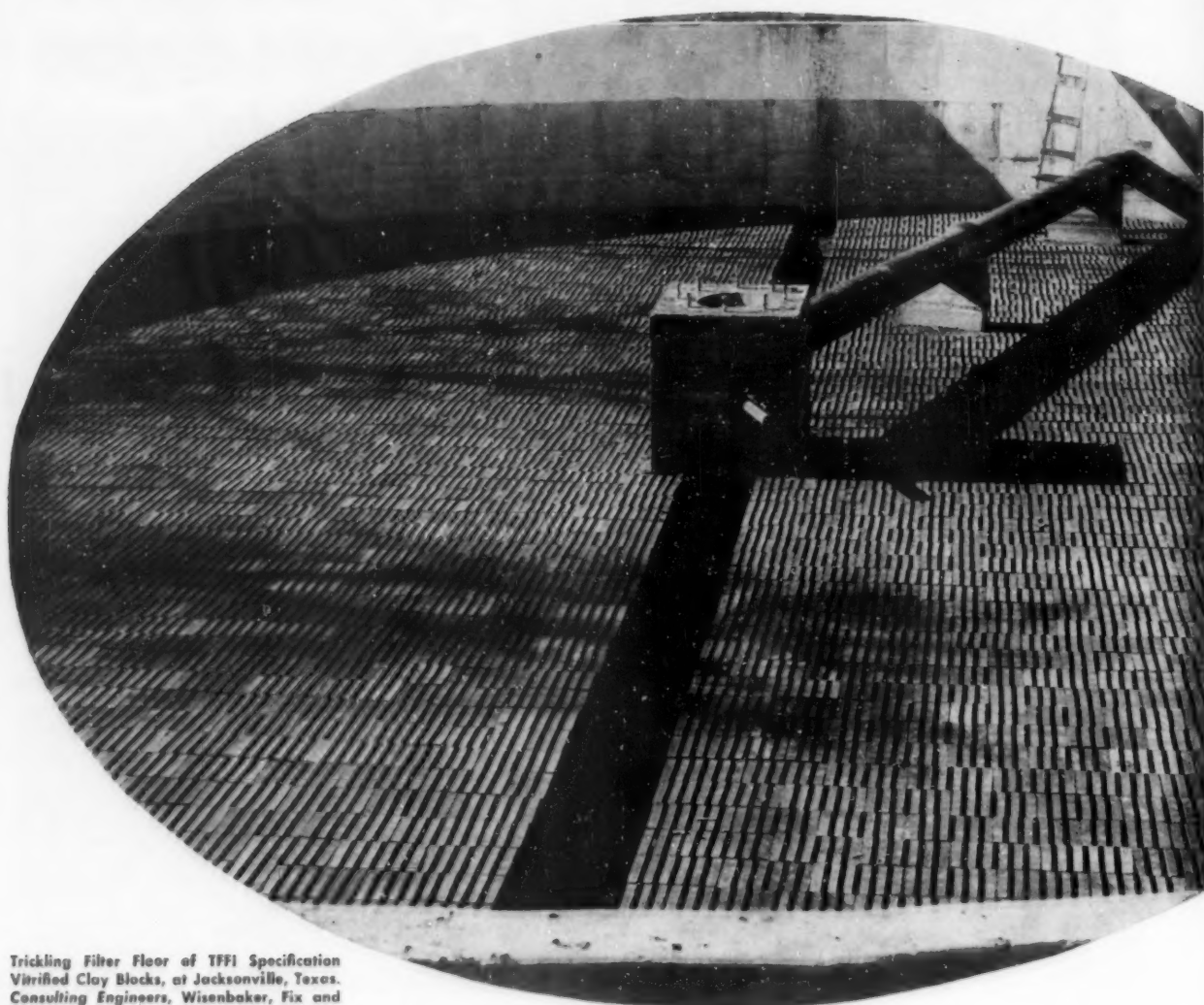
☐ Please have a representative call in person
☐ phone

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

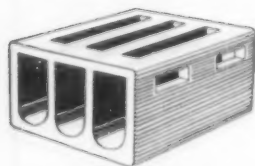
Insure the long term success



Trickling Filter Floor of TFFI Specification
Vitrified Clay Blocks, at Jacksonville, Texas.
Consulting Engineers, Wisenbaker, Fix and
Associates, Tyler, Texas. Contractors, Travis
and Miller, Tyler, Texas. Screens, sludge col-
lectors by Link-Belt Co. Filter Distributors and
digester equipment by Ralph B. Carter Co.

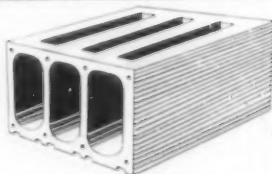


TRICKLING FILTER



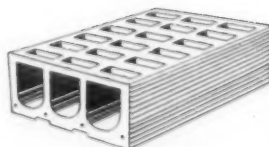
POMONA

Pomona Terra-Cotta Co.
Greensboro, No. Car.



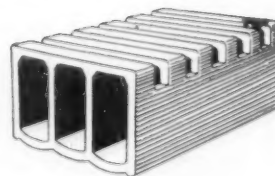
NATCO

Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.



DICKEY

W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.



TRANSLOT

Texas Vitrified Pipe Co.
Mineral Wells, Texas

of your Trickling Filters with

the Floor Blocks of TFFI SPECIFICATION VITRIFIED CLAY

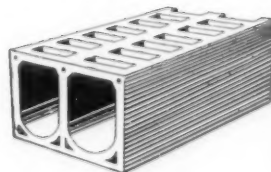
The Most Important Part

Of a trickling filter is the underdrains. When built of vitrified clay to TFFI specifications, they will safely carry highest hydraulic loadings; and they alone can withstand all the ravages of acids, alkalis and bacterial action. They are made in modern plants under rigid controls of quality that are impossible with any substitute material. Only they offer you a 50-Year Guarantee against damage by acids and bacteria. Plus long-term low cost, higher velocity flow, maximum ventilation and crushing strength, light weight and ease of laying.

Leaders in Ending Stream Pollution

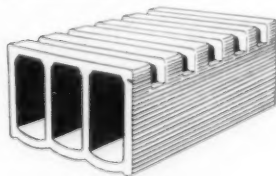
TFFI takes pride in its contribution of superior filter floors toward clean waters in America. Over 35% of the population is now served by more than 2,700 sewage works with trickling filters. *The six greatest advantages of these filters are:* low initial cost, low operating cost and long term maintenance costs. Overloads are no problem and operating personnel is at a minimum.

FLOOR INSTITUTE



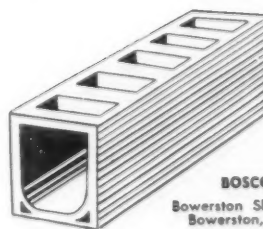
ARMCRE

Ayer-McCord Clay Co., Inc.
Brazil, Ind.



TRANSLOT

Cannelton Sewer Pipe Co.
Cannelton, Ind.



BOSCO

Bowerston Shale Co.
Bowerston, Ohio



This **PAYLOADER®** is



"Best piece of equipment we have ever purchased"

"The H-70 'PAYLOADER' with Drott 4-in-1 bucket is the best piece of equipment that we have ever purchased," says Peter J. Ellis, Vice President, Glenmar Construction Co., Inc., Rockville, Md. "It will move more dirt than any two competitive loaders that we have ever owned. We don't know how we ever did a job without it."

"Most useful machine I have ever used"

"I am using the H-70 with 4-in-1 in all phases of this contract," says Max Hutchinson, Glenmar's foreman. "The 4-in-1 versatility on rubber tires makes it the most useful single machine that I have ever experienced using in my 15 years of pipe work. Gives unlimited advantages that can't be determined until the need arises. Saves time and operating cost."



MORE than a tractor-shovel



The job: 16,000 ft. of storm sewer on Maryland State Route 193.

1. Glenmar's H-70 loading out excavated dirt unsuitable for backfill. The clam action of the 4-in-1 bucket does the job neatly and cleanly.

2. The powerful hydraulic clam action also grasps and moves old concrete curbing and chunks.

3. Pipe ranges up to 54" diameter — is carried to position for lowering-in.

4. Bulldozing, backfilling the trench, leveling and grading are also "PAYLOADER" jobs on this project.

HOUGH®



THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY



HOUGH, PAYLOADER, PAYMOVER, PAYLOGGER and PAY are registered trademark names of The Frank G. Hough Co., Libertyville, Ill.

THE FRANK G. HOUGH CO.

761 Sunnyside Ave., Libertyville, Ill.

Send booklet on all "PAYLOADER" models and many attachments.

Name.....

Title.....

Company.....

Street.....

City..... State.....

11-B-1

Clay Pipe handles Heavy Backfill

DEEP excavations, with their extra backfill loads, require the best pipe money can buy. In one of Los Angeles' largest sewer projects*, where these conditions were the rule rather than the exception, more than 7 miles of Clay Pipe in 15 through 27 inch diameters went into the line. Vitrified Clay Pipe was specified exclusively because it is the only pipe that does not rust, rot, corrode, or disintegrate. Chemically-inert, it is the only pipe never affected by the corrosive action of household or industrial wastes. Even after years and years under the ground, it retains its original supporting strength . . . never crumbles or deteriorates.

When your community plans sewer improvements, invest in the long-term benefits of Vitrified Clay Pipe. It is supplied in Extra Strength as well as Standard to meet every installation requirement . . . with new research-developed, factory-made, compression joints. Clay Pipe is backed by an exclusive, industry-wide guarantee . . . your assurance that *it never wears out.*

*The Havenhurst Interceptor Project

City Engineer: Lyall A. Pardee

Chief of Sewer Design Division: E. G. Studley

Contractors: J. S. Barrett of Santa Ana, Calif.
Missetch Bros. of Los Angeles, Calif.

Vitrified

CLAY PIPE

Never Wears Out

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D.C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 703 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 1401 Peachtree St., N. E., Atlanta 9, Georgia



ALCOA ALUMINUM BEAM GUARD RAIL IS AVAILABLE IMMEDIATELY

In less than a year, Alcoa® Aluminum Beam Guard Rail has gained tremendous acceptance. Proof? Twenty-five states have already included it in their specifications. But that doesn't mean short supply, because Alcoa's foresight led to stockpiling ample quantities and planning production schedules to meet any anticipated demand.

That means you can get Alcoa guard rail right now—with all of these benefits riding on every order: *No painting*, on or after installation, in spite of corrosive attack by road salt, industrial fumes, air-borne abrasives and weather. *Maximum safety* from high-strength Alcoa Aluminum alloys. *Lasting good looks* without the expense of maintenance.

Now is the time to get the full story. Learn how Alcoa Aluminum Beam Guard Rail can stretch taxpayers' dollars on any highway by calling your nearest Alcoa sales office (listed in the Yellow Pages of your telephone directory). Or write: Aluminum Company of America, 1912-L Alcoa Building, Pittsburgh 19, Pa.

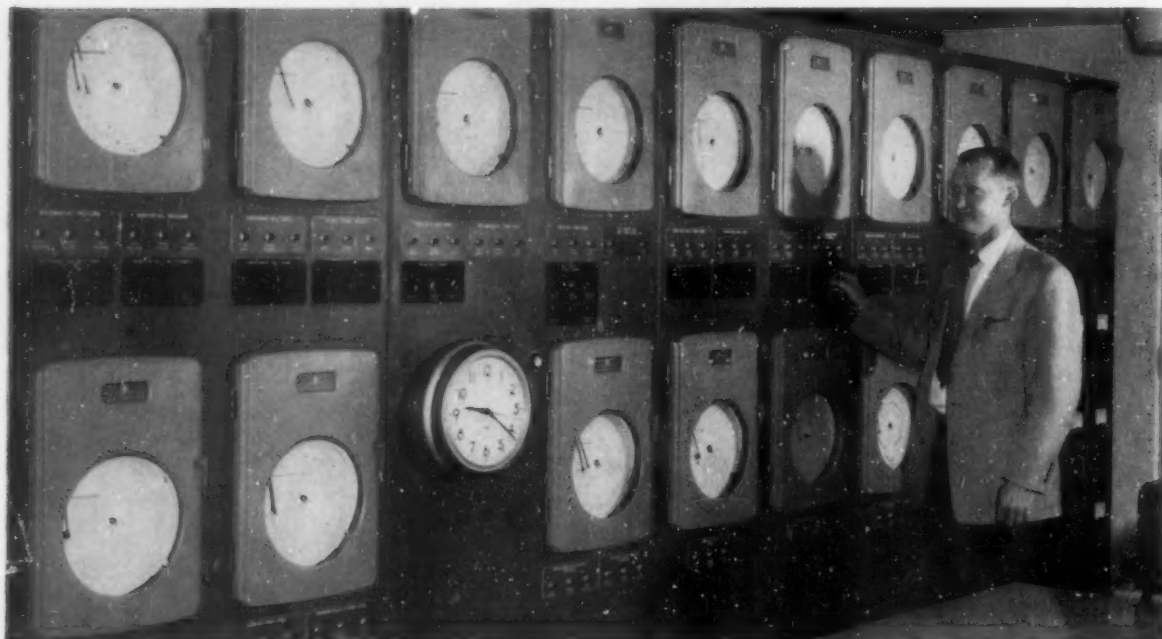


Your Guide to the Best in Aluminum Value


For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and the Emmy Award winning "Alcoa Theatre" alternate Mondays, NBC-TV

BILL CATLIN QUARTERBACKS ON 49 SQUARE MILE FIELD . . .

The Helix Irrigation District, La Mesa, California!



Bill Catlin, Helix Field Engineer, shows how one man can call the plays on operations at 40 remote locations scattered throughout the 49 square mile area. On this *one* panel, 28 levels, pressures, and flows are continuously and simultaneously recorded, 34 pumps can be automatically controlled (manual, on-the-spot control also provided) and valves can be opened and closed according to 4 remote valve-position indicators on panel.

 *Builders - Providence* **Synchro-Scan® Supervisory System**
Proves the Money-Saving Advantages of One-Man Supervisory Control!

Concentrated on one central panel is all the information needed to call the plays that will save the taxpayers' money . . . through more efficient operation of this widespread system.

Constant monitoring of distant Helix operations is done through audio tone signals . . . over five telephone loops involving two telephone exchanges and 95 transistor tone channels. The Synchro-Scan Supervisory System, featuring transistor tone equipment, is designed to save power, save space, save maintenance, and provide increased reliability and longer life.

If you are interested in a performance-proved supervisory control system which can provide your administrative staff with better information on a more efficient and economical basis, request Bulletin 240-P2A. Write: **B-I-F Industries, Inc., Utilities Sales, 356 Harris Avenue, Providence 1, Rhode Island.**



B-I-F INDUSTRIES

BUILDERS-PROVIDENCE • PROPORZIONEERS • OMEGA



CALCIUM CHLORIDE



KEEP TRAFFIC MOVING...

with Dow Calcium Chloride

When ice and snow strike highways, be ready! Supply traction fast with direct application of Dow Calcium Chloride. Dowflake®, 77-80% flakes, or Peladow®, 94-97% pellets, melt snow and ice like hot buckshot . . . and keep traffic rolling safely on ice-free pavement.

Many engineers have found that Dow Calcium Chloride is the ideal mixer with rock salt or abrasives for all-temperature ice melting. Rock salt loses effectiveness at temperatures under 10°, while calcium chloride continues its quick melting action down to 59° below zero. Use of a 2 to 1 salt-

calcium chloride mixture accelerates the action of the rock salt, thereby increasing its effectiveness at all temperatures.

Before the next snow or ice storm hits be sure you have a good supply of Peladow or Dowflake on hand. You may find it economical to order in bulk. For assistance on your specific winter problems by qualified highway engineers, or for literature pertaining to the handling, storing, mixing, and applying a winter maintenance mixture of calcium chloride and salt for ice control, contact THE DOW CHEMICAL COMPANY, Midland, Michigan.

For local assistance

Write THE DOW CHEMICAL COMPANY, CC401EC11, Midland, Michigan.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

PUBLIC WORKS for November, 1959

**CUT 20" CAST IRON PIPE
in Less Than 8 Minutes...**



**...with the New REED
ROTARY CUTTERS**

(4 sizes cover the range from 10" and iron to 24" steel pipe)

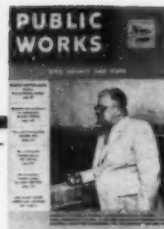
These one-man Reed Rotary Cutters cut large diameter steel or cast iron pipe faster and better than the heaviest power machines... and without electrical or explosive hazards. What's more, there's less digging in ditch-work! You need only a 4" to 6" channel under the pipe and a 45° to 60° arc for the handle swing. Reed Rotaries are easy to "carry in", too. The 20" size weighs only 68 pounds; separates into 3 easily carried parts. Patented pipe guide assures clean, right-angle cuts. Four razor blade wheels track perfectly, cut easily and are quickly interchangeable for steel or cast iron pipe.

- Write today for descriptive literature.

These typical cuts on 12, 16, 20 and 24" cast iron pipe illustrate the clean, accurate, right-angle cuts provided by Reed Rotary Cutters.



REED MANUFACTURING COMPANY
ERIE • PENNSYLVANIA



Robert W. F. Schmidt is Executive Director of the Tucson, Ariz., Airport Authority. For the past twenty-five years he has been engaged in and pre-occupied with aviation and airports. From 1934 to 1936, as an employee of the U. S. Bureau of Air Commerce, he visited nearly all parts of the nation. After two years with United Airlines, he accepted an appointment with the Civil Aeronautics Administration in 1938, serving as district airport engineer at Denver, project review engineer at Washington and Chief of the Airport Division at Los Angeles.

He went to Tucson in 1948, but continued to serve on advisory committees on aviation to the CAA Administrator and the Under Secretary of Commerce, playing an active role in the site selection, planning, engineering and operation of more than 250 of the nation's landing fields and airports. Since going to Tucson he has been engaged as consultant on construction, maintenance, operation and regulation of airports. He has been a contributor to many aviation publications and has participated in radio programs.

Following a year at Iowa State, Mr. Schmidt was employed by the Iowa State Highway Commission, but in 1929, switched to Curtiss-Wright and then to the airship operations staff of Goodyear. His professional affiliations include a directorship in the Municipal-Airport Division of the ARBA, and membership in the Society of Airway Pioneers and the Texas and the American Associations of Airport Executives, serving the latter as president in 1957. He is president of the National Foundation for Asthmatic Children. His principal hobby is railroading. Mr. and Mrs. Schmidt live in Tucson.

WHATEVER THE LOAD...WHATEVER THE ROAD
Quality components matched to YOUR exact needs

Brockway

HUSKIE



TOPS IN PERFORMANCE—
gives you more ton miles with less downtime

If trucks are the tools of your business, profitable operation depends on your choice of the right trucks for your job. In the new Brockway Huskie, every major part is specifically selected to fit your exact requirements. It is your assurance of custom-built efficiency and economy that no mass-produced truck can equal. Call your Brockway representative. Let him show you how Brockway can point your way to higher profits.

**A few of the NEW
Brockway Huskie features:**

- Wider choice of power—gasoline or diesel
- Larger cooling capacity
- Improved power steering
- All steel Safety-View cab
- Dual headlights
- Step-Aside fenders
- Easy-Access maintenance



A Living Legend
of the Highway for more
than 45 years.

BROCKWAY
MOTOR TRUCKS CORTLAND, N. Y.

Division of Mack Trucks, Inc.



Long sections can be handled with light equipment.



Connecting half-bands are imbedded in asphalt.



Connecting half-bands are bolted, for a tight, leak-proof joint that won't pull apart.

Republic *FREE FLOW* Sewer Pipe speeds up sewer construction

Thousands of new sewers are needed throughout the country as the result of the building boom. In fact, some communities have ruled that sewers must be installed before any more building permits will be issued. The pictures on this page illustrate how Republic *FREE FLOW* Sewer Pipe can speed up sewer construction.

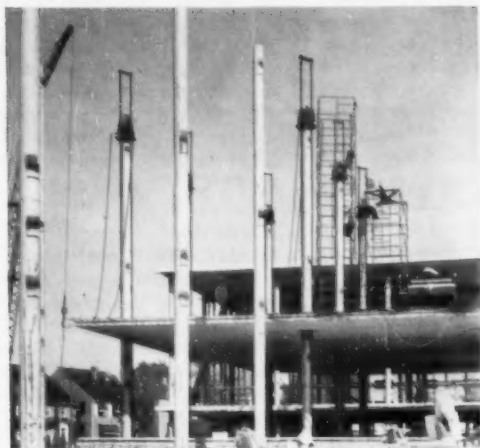
They show the 1410-ft. installation of 24"-diameter Republic *FREE FLOW* Pipe on Puritas Road, Cleveland, Ohio. This job was completed in *days* instead of months, because *FREE FLOW* is:

1. Lightweight . . . easy to transport, easy to handle.
2. Furnished in long sections . . . for easy installation.
3. Easy and quick to connect with leak-proof joints.

In addition a *FREE FLOW* installation gives you:

4. Flexible strength . . . ability to withstand flexure without damage . . . joints that won't pull apart.
5. No breakage during installation.
6. Non-spalling characteristics.
7. Superior erosion- and corrosion-resistance.
8. Free flow without turbulence.

Get a combination of all these superior features in Republic *FREE FLOW*, the corrugated, riveted, galvanized, coated metal pipe with the smooth, asphalt-lined interior surface. Mail the coupon for your copy of Republic *FREE FLOW* Sewer Pipe, ADV. 793.



◀ **TIME AND MONEY WERE SAVED** when Republic Steel Pipe was used in erecting the Tremco Building, Cleveland, Ohio. Slabs were poured on ground, then gradually hoisted up 10 3/4-inch diameter pipe, by means of hydraulic screw jacks. Scaffolding, elevators, etc., were eliminated. Slabs were raised at a rate of 3' per hour.



◀ **FOR FAST, DEPENDABLE, FASTENING** in highway and building construction, specify Republic Hook-Anchor-Foundation Bolts. Various types and sizes are available to meet specific job requirements, with dimensions ranging from 1/2" by 6" (over-all length) to 1/2" by 20" (over-all length). They can be supplied with regular square nut and flat washer, not assembled—or can be furnished fully assembled, if you prefer.



◀ **QUICK, TROUBLE-FREE PERFORMANCE** is yours when you use Republic Flexible Plastic Pipe to bring in construction water... or drain flooded excavations. Made of tough polyethylene, it resists abrasion and the effects of acids and alkalis. In addition, it is immune to electrolytic action. Lightweight and easy to cut or join, it can be used on job after job.



REPUBLIC STEEL



*World's Widest Range
of Standard Steels and
Steel Products*

REPUBLIC STEEL CORPORATION

DEPT. PK-7471-A

1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

☐ Please send me a copy of Republic FREE FLOW, ADV. 793.

Please send more information on:

☐ Corrugated Pipe ☐ Steel Pipe
☐ Flexible Plastic Pipe ☐ Bolt and Nut Products

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____



BITUMINOUS PATCHING MIXES AND SEAL COATS

This 37-page bulletin contains two papers sponsored by two committees of the Bituminous Division, Department of Materials and Construction, of the Highway Research Board, and presented at the 37th Annual Meeting. The first, "Cutback Asphalt Patching Mixtures," by J. R. Bissett, presents some of the results of a research project at the University of Arkansas. This work was undertaken with the view of producing a cutback asphalt mixture for use in highway patches. The second, "Seal Coats: Laboratory Contributions Toward Better Performance," by Ernest Zube, describes studies relating to improvement of seal coats, including development of tests, apparatus, materials and application

procedures. Copies are 80¢ each and are available from Highway Research Board, 2101 Constitution, Washington, D. C.

CIVIL ENGINEERING HANDBOOK

This handbook is designed to give the information needed by men who actually conceive, plan, design and build civil engineering structures and projects. Presented in ready-reference, easy-to-use format is the specific information you want on the theory, fundamentals and practice of every branch of civil engineering. This revised and enlarged fourth edition is edited by Leonard C. Urquhart, Consulting Engineer, Porter, Urquhart, McCreary & O'Brien. The publishers are McGraw-Hill Book Co., 330 W. 42nd St., N. Y. 36, N. Y., and the handbook is \$17.50 per copy.

NON-RIGID PAVEMENT STRUCTURAL DESIGN

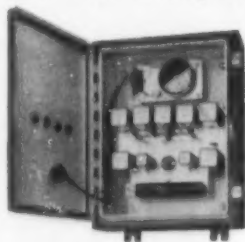
This report reviews the material contained in earlier reports on this subject (1946 and 1949), with particular emphasis on the development of static-load test procedures and measuring techniques; and it presents most of the static-load test data. Methods of obtaining and

tabulating these data are described in sufficient detail to permit analyses by other investigators. Also included are details of a study of moisture movement in a base course due to temperature change. Special Report No. 46; 56 pages; \$1.20. Highway Research Board, Washington 25, D. C.

ALUMINUM CONSTRUCTION MANUAL

This Manual is a valuable working tool for designers on the use of aluminum beams and columns as structural materials. Broken into five parts the Manual contains the following: Data that are most frequently needed by structural estimators and engineers engaged in designing aluminum structures after the forces to be resisted have been determined; dimensioning, weight and other data useful in preparing estimates and drawings; allowable-load data for beams and columns of alloy 6061-T6, calculated in accordance with the specifications for this alloy published by ASCE; specifications for structures of aluminum alloys 6061-T6 and 2014-T6 published by ASCE; data on properties of aluminum structural alloys and material on design loads in building published by American

PRESET AUTOMATICALLY TIMED PUMP CONTROLS FOR GASOLINE, DIESEL & GAS ENGINES



for
**OIL WELL
&
PIPE LINE
PUMPING**

Synchro-Start's Program timer control can be PRE-SET for the LENGTH OF TIME, TIME OF DAY OR NIGHT and the DAYS OF THE WEEK the engine is required to RUN, as well as the time it is to be stopped.

Incased in a steel, weather proof cabinet it contains a standard Synchro-Start Automatic Engine Control together with a timer driven by a governed D.C. motor. No commercial power is required as all current is taken from the engine battery.

SYNCHRO-START PRODUCTS, INC.
8151 N. RIDGEWAY AVE. • SKOKIE, ILLINOIS

COAST TO COAST



MONARCH ROAD MACHINERY COMPANY

1331 Michigan St., N. E.
Grand Rapids 3, Michigan

MONARCH

POWER HYDRAULIC CONTROLS

*lift and lower
snow plows
automatically!*

Snow removal is easier, faster, more economical. See your dealer or write for illustrated folder.



DYNAMIGHT
Battery-Operated



HY-LO-JACK

HY-LO-JEEP
Fan-Belt Driven

use **MUELLER**® angle meter stops

... the angle meter stop with "O" ring seal!

Heavy phosphor bronze spring washer under cap seats the key and permits it to be unseated slightly for easy turning.

Large bronze cap protects ground key surfaces and includes strong, accurate check. Downward force on cap unseats key slightly for easy turning. Flat head or lock wing.

Shear-resistant silicon bronze drive-lock pin solidly anchors cap to key.

"O" ring gives dependable, water-tight, **double** seal at top of key and prevents leakage when key is unseated during operation of stop.

Square bronze ring solidly secures meter coupling nut and permits it to swivel freely. Nut is drilled for wire seal.

Heavy inverted bronze key is accurately machined and individually ground and lapped into the body for water-tight contact over its entire seating area.

Inverted key design uses water pressure on key as additional seating force. The higher the inlet pressure, the greater the seating force.

Single side port in key permits rotation of key 180° from "open" to "closed" position. Greater ground key sealing surface gives longer stop life.

Heavy water works bronze body, key, cap and coupling nuts give maximum strength and resist corrosion.

Opposed convex surfaces of the coupling give line contact initially to permit joint to be made-up quickly and easily.

End of riser pipe flange is not compressed by convex surfaces and gives greater resistance to pipe pulling out.

Mueller Copper Service Pipe Connection inlet includes regular Mueller Copper coupling nut and eliminates loose connecting ring. Meets AWWA specifications.

Extra long skirt on coupling nut supports pipe and prevents leaky joints due to riser pipe movement.



Before your next water meter installation, carefully consider these features. They are typical of the great attention to detail in research, design and engineering which becomes a part of every

Mueller product made for the water industry. Mueller Angle Meter Stops are available in a complete range of sizes and styles.

Write for complete information.



MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

Standards Association; and miscellaneous reference data considered useful to structural engineers and designers. Copies of this Manual are available from The Aluminum Association, 420 Lexington Ave., New York 17, N. Y., at \$3 each.

PERFORMANCE OF GRANULAR SUBBASE UNDER CONCRETE

The three papers in Bulletin 202 presented at the 37th Annual Meeting of the Highway Research Board are as follows: "Concrete Pavement Subbase Study in Ohio," by L. D. Childs and F. E. Behn, reports the observed condition of an experi-

mental highway constructed in 1952. Several conclusions and indications are given. "Performance of Subbases for Concrete Pavements Under Repetitive Loading," by B. E. Colley and W. J. Nowlen, reports laboratory data on the performance of subbases under 500,000 repetitions of load. The type and gradation of subbase materials, and the placement condition relative to density and moisture content, were evaluated. "Effect of Base Course Gradation on Results of Laboratory Pumping Tests," by W. P. Chamberlin and E. J. Yoder, reports results of a laboratory study to investigate the performance of a variety of base

course samples with different gradations. Copies of this bulletin are \$1.60 each and are available from Highway Research Board, 2101 Constitution, Washington, D. C.

DYNAMICS OF FRAMED STRUCTURES

This 355-page introductory treatise applies the theory of structural dynamics primarily to buildings and bridges. Utilizing two mathematical tools (matrices and orthogonal functions) as engineering tools, the author presents the analytical aspects of dynamic disturbances in structures. Lumped parameter and distributed parameter systems comprise the two major topics that are fully described. The author is Grover L. Rogers, Director, Dept. of Engineering Science, Florida State University. The Publishers are John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y., and the cost per textbook is \$10.25.

STATISTICAL ABSTRACT OF THE UNITED STATES—1959

The 80th Annual Edition of the statistical abstract has been prepared under the direction of Edwin D. Goldfield, Chief, Statistical Reports Div., U. S. Dept. of Commerce. The statistics are on the social, political and economic organization of the United States. The text is designed to fulfill two functions: First, to serve as a convenient volume for statistical reference; and second, to serve as a guide to other statistical publications and sources. This edition presents data for the most recent year or period available during the early part of 1959. Copies are \$3.50 each and are available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

MOMENT ANALYSIS FOR ABUTMENT WINGWALLS OF VARIABLE THICKNESS

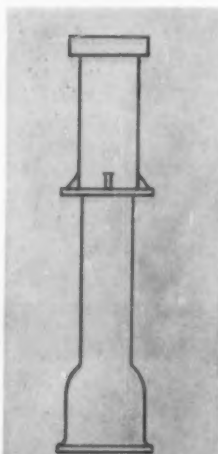
Bulletin 184, entitled "Moment Analysis for Bridge Abutment Wingwalls of Variable Thickness," gives an analytical procedure for the structural analysis of wingwalls of variable thickness. As an example a typical thickness wingwall is analyzed for moments which are presented as moment contours. Written by C. L. Hulsbor, Professor of Civil Engineering, Iowa State College, and Ti-ta Lee, formerly Graduate Assistant, Iowa Engineering Experiment Station. Cost is 75¢. Copies are available from Iowa State College, Ames, Ia.



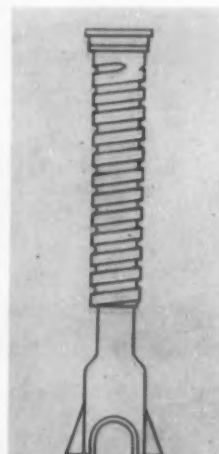
BUFFALO MUNICIPAL CASTINGS

are available in every size and style!

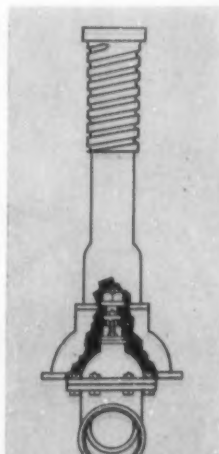
No matter what size, shape or style municipal casting you may desire — you're practically sure to find a "Buffalo" casting to serve your needs. Or, where desired, castings may be made to your own specifications. Whether you need valve, service or roadway boxes, meter boxes, manhole rings and covers or other municipal castings, you'll find all "Buffalo" castings designed for service and dependability.



2 pc. sliding type
adj. 5 1/4" valve box



2 1/2" water or gas
ext. service box



3 pc. screw type
5 1/4" valve box

Prompt quotations given on all your standard or special gray iron or non-ferrous castings.

Write or wire Dept. J for Bulletin MII.



BOX 55 — STATION B DE 6764 BUFFALO 7, N.Y.

Outstanding Performance FOR MORE THAN THIRTY YEARS...



...THAT'S THE RECORD OF McCONNAUGHAY WEATHER-PROOF ASPHALT EMULSIONS

PROVEN SERVICE... McConnaughay Weather-Proof Asphalt Emulsions have a record of satisfactory performance extending over thirty years. Their versatility and excellent reputation as quality roadbuilding materials have resulted from formulations carefully developed without regard to ionic classification.

Anionic asphalt emulsions with long and satisfactory service records are available from McConnaughay Licensees. Nonionic emulsions used over the same period of time are also available. The experience record for cationic asphalt emulsions from McConnaughay goes back over ten years. However, these emulsions are not yet considered to be in the same class of proven service as the other materials.

THE McCONNAUGHAY POSITION... Recognizing the thirty years of excellent experience with McConnaughay Asphalt Emulsions of the anionic and modified anionic types (with all kinds of aggregates), we will continue to recommend these materials as *quality products of known performance*.

We do not favor wholesale replacement of these asphalt emulsions with relatively untried binders of any variety. We do, however, *offer our experience* with asphalt emulsions of the cationic and nonionic types to highway engineers and roadbuilding agencies interested in their use.

ALL GRADES AVAILABLE... All McConnaughay Licensees are prepared to furnish all grades of asphalt emulsions, *each the best of its type*. If you are figuring on highway, street, or general paving, get in touch with your nearest McConnaughay Licensee listed at right or contact the main office.

McCONNAUGHAY LICENSEES Operating K. E. McConnaughay Emulsified Asphalt Plants

FLORIDA

E. A. Mariani—Emulsified Asphalt
Hooker's Point, Tampa

ILLINOIS

Emulsions, Inc.—Lawrenceville

INDIANA

Bituminous Materials Co.
P. O. Box 1140, Terre Haute
Wabash Valley Asphalt Co.
Terre Haute
Walsh & Kelly
R. R. No. 2, Gary
Brookman Construction Co.
17th & Gharkey Sts., Muncie
Fauber Construction Co.
Lafayette
Asphalt Materials & Construction, Inc.
960 East 22nd, Indianapolis 2
Bituminous Materials Co.
E. Swihart St., Columbia City

IOWA

Bituminous Materials & Supply Co.
409 Fifth Street, West Des Moines
Plants: Spirit Lake, Le Mars, Carroll,
Algona, Lehigh, Davenport

KENTUCKY

Emulsified Asphalt Co.—Kuttawa

LOUISIANA

Bituminous Materials Co.—Metairie
Serving Alabama, Mississippi, and
Louisiana

MAINE

Doherty and Swearingen Co.
53 Main St., Yarmouth

MASSACHUSETTS

James Huggins & Sons, Inc.
Medford & Commercial, Malden 48

MICHIGAN

Bituminous Materials Co.
318 Atlantic St., Bay City
Bituminous Materials Co. Escamaba
Bituminous Materials Co.
416 S. Water St., Jackson

NEW YORK

Knight Paving Products, Inc.
1655 Union Rd., Gardenville
Knight Paving Products, Inc.
Vine Street, Ithaca
Knight Paving Products, Inc.
1980 East Avenue, Rochester 10
Knight-Bitumen Corp.—Watertown
Albany Asphalt & Aggregates
75 State St., Albany
Bimasco, Inc. (2 plants)
312 Brook Street
Bayshore, L. I., N. Y.

SOUTH CAROLINA

Seaco, Incorporated
2700 Industrial Drive, Columbia

TENNESSEE

Asphalt Products Co., Inc.
Powell Ave., Nashville 4

CANADA

T. J. Pounder & Co., Ltd.
1474 Wall St., Winnipeg, Man.
Three plants

Eastern Representative:

John A. Dow
157 Church St., New Haven 10, Conn.

K. E. McCONNAUGHAY

LAFAYETTE
INDIANA

EMULSIFIED ASPHALT PLANTS AND PROCESSES

Huber-Warco on the job

.....

BONUS features designed into each
Huber-Warco grader mean
more profitable grading operations



Along the River Road near Warrensburg, New York, a Huber-Warco 7-D grader works at shoulder maintenance for the Warren County Department of Highways.



Here a Huber-Warco 6D-2 grader carries out a ditching assignment for the Clinton County Road Commission of St. Johns, Michigan.

H-W scores on all county

Whether the job requirement is ditching, bank sloping, maintaining shoulders, spreading gravel or just routine grading assignments, a Huber-Warco motor grader will do the job faster and better.

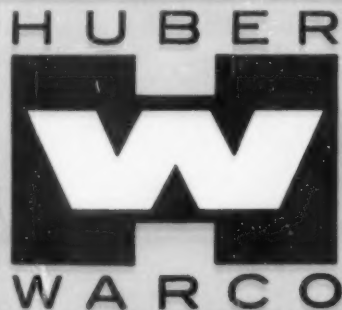
Let's talk about the 6-D and 7-D series graders. These four models have a horsepower range of from 102 to 150 h.p. These powerful diesel engines are combined with a torque converter, power shift transmission and tail-shaft governor.

The torque converter makes more usable power available, brings new ease of operation and protects vital parts. The tail-shaft governor automatically adjusts engine RPM to meet any load condition, maintaining any working speed set by the operator.

The power shift transmission permits quick shifts under full load with no interruption in power flow from the engine to the load. This Huber-Warco power shift transmis-

.....

Terms up to 36 months and rentals available . . . contact your Huber-Warco distributor.





The Franklin County Highway Department at Winchester, Tennessee, called on their Huber-Warco 6D-2 motor grader for a bank sloping assignment.

grading assignments

sion **ELIMINATES THE NEED FOR A MASTER CLUTCH.**

A unique Huber-Warco feature is the completely cab-controlled hydraulic blade movement for bank sloping. The operator can move the blade to a 90-degree bank sloping angle on either side, without ever leaving the cab. There are no manual adjustments.

A power-sliding moldboard, operated from

the cab, is standard. There's no deviation from the line of travel. This enables the operator to keep his wheels on good footing.

There are many other bonus features including high axle clearance; easy to reach controls; and 360-degree blade rotation. The best way to get all of the facts is to see your Huber-Warco distributor. He will show you why Huber-Warco motor graders mean fast, efficient work on any grading assignment.

Huber-Warco Company

Marion, Ohio, U.S.A.

**engine
power**
BY CATERPILLAR

Why your best when you equipment



A Cat D318 Series G Engine powers Buffalo Springfield Kom-pactor shown on Iowa Interstate Number 35. A Cat D318 Electric Set furnishes electric power for a Butler Dry Batch Cement Plant handling 10 cars of cement every 10-hour day. Why Caterpillar? Because of prior experience with dependable Cat Engines in their earthmoving spread.

"We've found we can depend on Caterpillar power. Dust or rain, it's all the same to us," says M. L. Phelps, Supervisor of Cowlitz County Road District Number 1, Washington. A Cat D337 Series F repowers the district's Pioneer No. 4022 30-in. x 18-in. Triple Roll Crusher, plus two screens, producing 50 yds. per hour of $\frac{3}{4}$ -in. minus rock.



Power problems? Your Caterpillar Dealer Engine Specialist will work with you and your engineering staff to choose the right engine power. He's close at hand, always available.

Cat Engines use the least expensive diesel fuel you can buy. Safe diesel fuels cost less than gasoline, may lower insurance rates. Caterpillar Natural Gas Engines even operate on sewage gas.

Turbocharging gives you more horsepower per pound of engine weight with operating economy and long life. It also lowers the engine's cooling system heat load.



investment is Caterpillar choose engines for new or for repowering

Whether you're replacing the worn-out engine of otherwise good equipment, or specifying the engine in new equipment, you want the best performance and service life for your money. That's what the men in charge of choosing power for equipment on these pages wanted. And that's what they got when they specified Cat power. That's what you'll get, too.

Cat Diesel Engines were created with just that idea in mind, to power Caterpillar earthmoving equipment. This led to the development of engines that are free from delicate checks and adjustments—simple to service and to operate. They perform smoothly and efficiently under a wide variety of loads. And your fuel costs are lower because you can use the lowest cost fuel available. Parts for your engine are always near and will be for as long

as your engine is in use. That will be a good long time because Caterpillar Engines and Electric Sets often outlast the equipment they power.

Your Caterpillar Dealer Engine Specialist will tackle engine power problems with you. Probably he'll be able to give you data on Cat Engines and Electric Sets already working in equipment like yours. Talk to him early when power is involved.

FREE informative guide books on your power needs.
Write for the ones you need.

Engines for New Equipment—request "How to Judge Engine Quality"

Repowering Present Equipment—ask for "Handbook for Selecting Repowering Engines"

Standby Power—read "Guidebook for Emergency Power"

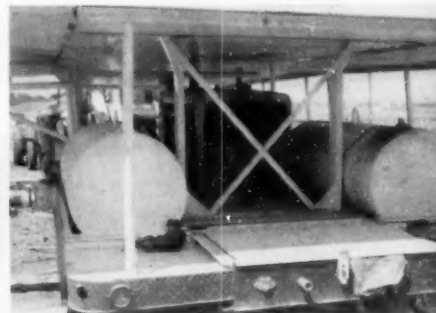
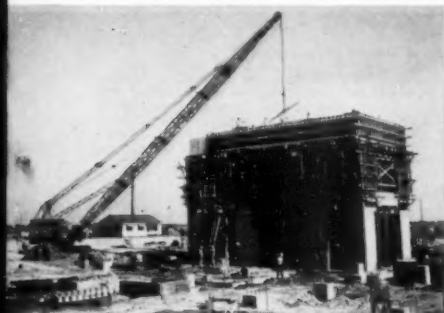
CATERPILLAR

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U. S. A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

The engine powering this utility-owned P & H Model 855 B.L.C. with 100-ft. boom is a Caterpillar D342. Other Caterpillar engines power all sizes of cranes, excavators, drag lines.

A Caterpillar Diesel D318 provides power for the backhoe making excavation for installing 16,000 ft. of 24-in. cast-iron water main. While another D318 is in a crane which handles the pipe.

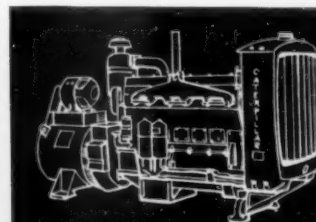
Shown drilling a 760-ft.-deep 30-in. municipal well in Derby, Colorado, this Reverse Circulation PORTADRILL is powered by a compact Caterpillar D311 Diesel Engine.



You're sure you're getting the power you specified and paid for with Caterpillar Engines and Electric Sets. You get notarized certificate of power, backed by Caterpillar Tractor Co.

You're never far from Caterpillar service and genuine Caterpillar parts. No matter how many years your engine or electric set serves you, parts and expert service always are available.

Caterpillar Diesel Engines (75 to 650 HP) and Electric Sets (30 to 375 KW) come in portable or permanent types, for use in disposal plants, road equipment, water works, utilities.



Equipment and Materials for your PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

Birds Beware

29. ... of buildings protected with BURCO chemical bird repellent. Word soon gets to the farthest nests that those are places to stay away from. A free folder tells you what every bird soon knows. Address Burr Chemical Co., Rockford, Ill., or check the card.

Put the Kids on Rubber

36. ... and save bruises and bumps. "SAF-PLA" rubberized playgrounds make friends of parents and patrons. Can be applied to blacktop, concrete, etc. You owe it to the children to learn about "SAF-PLA." Write U. S. Rubber Reclaiming Co., Inc., Box 365, Buffalo 5, N. Y., or check the card.

Se You Plan Fencing?

39. Then learn now about the latest—Kaiser Aluminum's chain link fence, adding the many advantages of aluminum to those that chain link fences have always had. For 12-page booklet with specifications, etc., address Kaiser Aluminum & Chemical Corporation, Kaiser Bldg., Oakland 12, Calif., or check the card.

To Ease Your Way into Automation and Instrumentation

43. This 16-page brochure offered by Panellit, Inc., 7401 N. Hamlin Ave., Skokie, Ill., points the way to solutions for your plant control problems, from installation to start-up. Address Panellit or check the card.

To Avoid Paint and Coatings Errors

50. First consult "A Catechism on Categories of Corrosion," a pocket sized brochure that enables you to share the expert knowledge of Hercules Powder Co., Cellulose Products Dept., Wilmington 99, Del. Finding out is free; not knowing could be costly.

A New Note

62. ... on precision hot spray bars. If your bituminous distributor is not giving complete spray bar satisfaction, this will repay an inquiry, of Berry Corp., Stone Road, Lexington, Ky., or check the card.

Where Does It Go From Here?

63. That is the title of new 12-page booklet, D 930, with thorough discussion of garbage disposal by sanitary landfill method. Read the latest report from the experts. Caterpillar Tractor Co., Peoria, Ill., or check card.

Water and Sewage Works Designers

73. Can get much helpful data on concreting in this area of public works by writing for bulletin MBR-F5. Address The Master Builders Co., P. R. Dept., Cleveland 3, Ohio.

Speed Bridge Building With Precast Decks

75. 20 illustrated pages, giving much data on bridge building with precast concrete decks. Every bridge designer and builder should have this booklet. Address Portland Cement Association, 33 W. Grand Ave., Chicago 10, Illinois.

Some Folks Want To Lift Digester Efficiency

97. If you are one, here's a new 8-page booklet containing details you will welcome. Just ask Walker Process Equipment Inc., Aurora, Ill., for their new Bulletin 25-S-91 on Walker "Gaslifters" or check the card.

To Keep Concreting Going in Cold Weather

99. A summary of "Recommended Practice for Winter Concreting." Utterly timely. Issued by Calcium Chloride Institute, 909 Ring Bldg., Washington 6, D. C. Write them or circle this number on card.

Roll Your Own (Roads) With Galions

101. New 12-ton, 9-wheel pneumatic-tire roller illustrated, diagrammed and explained. For a quick picture of this efficient new model ask for Bulletin No. 434 from the Galion Iron Works & Mfg. Co., Galion, Ohio.

There's A New Hydrant In Town!

119. New H100 Manual describes it and its bronze-to-bronze seat ring threads, permanent lubrication and unique seat removal. Latest addition to AWWA-conforming line of The A. P. Smith Mfg. Co., East Orange, N. J. Write them or check the card.

Backfill Rammer Packs a Heavy Punch

120. Powerful Wacker Vibro-Rammer weighs only 115 pounds so it's in the Bantam-weight class, but it delivers ten powerful blows per second to compact 20 square feet per minute. Durable, compact and easy to operate, it gets into tight corners and meets toughest compaction requirements. Full details from Wacker Corp., Hartford, Wisc.

Save Time, Labor and Shoe Leather

164. ... with truly centralized controls in treatment plants. New 12-page brochure shows how to do this in latest publication of fluid-processing specialist, The Permutit Co., Div. of Pfaufler Permutit Inc., 50 West 44th St., New York 36. Address them or check the card.

Weeds, Grass Worry You?

170. When you kill weeds and grasses with "Ureabor" or "Polybor-Chlorate" they stay killed. Non-selective, easy to use. Now is time to kill. New circulars. U. S. Borax & Chemical Corp., 630 Shatto Place, Los Angeles 5, Calif. Check the reply card and get full story.

Watch TV in Your Sewers!

179. Here's a new low cost TV camera for showing leaks or breaks in sewers. Ingenious, effective and economical. Pinpoints trouble accurately. Saves costly "blind" digging. Literature free from Industrial Pipe Repair Corp., 2100 N. Dixie, Wilton Manors, Fla. Check the reply card now.

Lick Big Snows Faster

183. Ram Rotary Snow Plow and Loader. Designed especially for use on the Hough Payloader. Gives you one more big use for your Payloader. Successful 13 years. Get bulletin with a lot of new snowplowing ideas from Ram Mfg. Co., 10001 Minnetonka Blvd., Minneapolis 26, Minn., or just use the reply card.

When The Power Fails

197. Keep going with standby power. Booklet describes Diesel-driven electric plants in detail, with specifications and illustrations. Check the reply card for D. W. Onan & Sons Inc., Minneapolis 14, Minn.

Data Book For Engineers

199. New Link-Belt Catalog (No. 2617) includes all recent additions to their Water, Sewage and Industrial Waste treatment equipment. All designing engineers will want this one. Write Link-Belt Co., Colmar, Pa., or use the card.

Need Tractor Versatility?

220. Two bulletins tell of various uses—several of them surprising—to which Oliver 550 All-Purpose wheel tractors can be put. Much valuable information is yours for the asking of the Oliver Corp., Ind. Div., 19300 Euclid Ave., Cleveland 17, Ohio., or circle this number and mail card.

New Light on Lighting Standards

256. ... in a 32-page, 2-color catalog, giving detailed descriptions, dimensions, specifications and illustrations of these aluminum alloy lighting standards. For your copy address Adv. Dept., Hubbard & Co., 200 S. Michigan Ave., Chicago 4, Ill., or check the card.

USE THIS CARD to get detailed information
on products and services mentioned in this issue.
Circle numbers below and mail today.

Circle numbers from page 60 to 69

| | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 |
| 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 |
| 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
| 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 |
| 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 |
| 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 |
| 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 |
| 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 |
| 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 |
| 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 |
| 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 |
| 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 |
| 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 |
| 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 |

Name _____
Address _____
City _____ State _____ Zip _____
I enclose \$ _____
A NEW, THIS CARD ONLY

Greenville, Miss. Cuts Costs . . . Improves Refuse Collection with DUMPMASTER

Officials, Merchants Enthusiastic Over New Type Service

After five months of operation, Greenville, Mississippi officials, merchants and sanitation department employees believe their DEMPSTER DUMPMASTER system is the answer to low-cost, sanitary refuse collection.

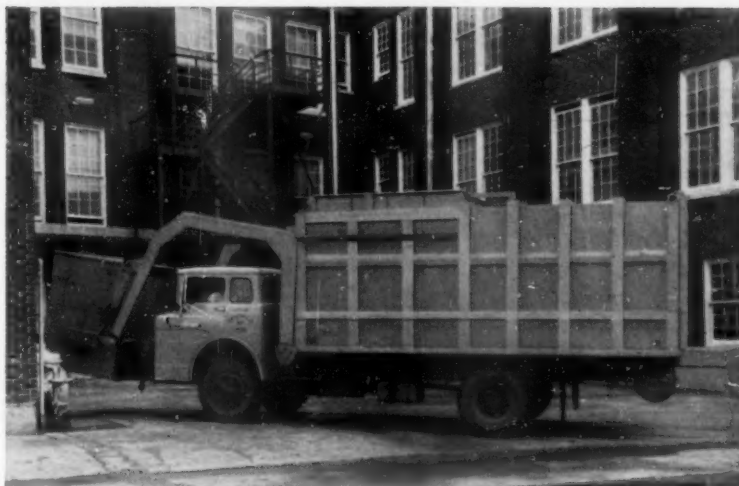
This prosperous, progressive city on the banks of the Mississippi River installed one truck-mounted Dumpmaster and 39 containers in sizes ranging from three through six cubic yards in February of 1959. Five months later, City Engineer John Teunisson who, together with a far-sighted city council instituted the installation, reports that the new system has exceeded his highest expectations for economy and efficiency.

Members of the Sanitation Department who have closely supervised operation of the new equipment are particularly pleased with the Dumpmaster's ability to handle big capacity containerized refuse, as well as hand-loaded residential



John Teunisson, veteran city official, likes Dumpmaster economy.

pickup routes. It is pointed out that this flexibility enables them to keep the equipment busy, thereby saving the taxpayers money.



Dumpmaster picks up 6 cu. yd. container behind elementary school.

Schools and Downtown Areas Containerized Residential Routes Served By Dumpmaster

At present, schools and the downtown business district, where large volumes of refuse accumulate, are served by big capacity containers, with all 39 locations being given daily service. Additionally, several manual loading routes in residential areas are served by using the Dumpmaster as a conventional packer truck.

City Engineer Teunisson estimates that the school containers will pay for themselves in less than one year as a result of time savings with the new system. The Dumpmaster has made possible a \$7,000 reduction in the Sanitation Department Budget. The size of these savings and opportunities for further improvement have led Greenville to set up a goal of over 100 containers as soon as expansion funds become available.



Typical installation behind a store in the downtown business district of Greenville.

Tax-Fee Plan Covers Expenses

Greenville's residential and school refuse collection is tax supported, but commercial refuse carries a charge to the merchant based on the time necessary to make a pickup with a conventional packer truck and its crew. The monthly charges are based on the number of pickups, times the number of minutes required, times \$2.75 per minute. These proceeds are applied to pay for the container, the Dumpmaster and the operator's salary. Because of the high speed collection, the city saves enough over manual operation to offer free service to any merchant who purchases his own container.



Dumpmaster dumps huge load at the efficiently operated landfill.

DEMPSTER BROTHERS
Inc.

Knoxville 17, Tenn., Dept. PW-11

To order these helpful booklets check the reply card opposite page 34.

NEW LISTINGS (Cont.)

First New Cast Iron Pipe Maker in Years

257. Pipe buyers will want this new booklet of Griffin Pipe Div. of Griffin Wheel Co., Council Bluffs, Iowa. Ask them or check the card.

Florida Please Disregard

262. ... but if you are in the big-snows country, there's help in the new line of snow-plow truck models of FWD Corp. Summer—useful, too, for hauling, grading, etc. Ask for new brochure "40 New 'Special' Snowplow Models." FWD Corp., Clintonville, Wis.

Use The Reply Card

Accuracy In Chemical Proportioning

263. For chlorinating swimming pools or drinking water, for feeding polyphosphates, fluorides, soda ash, alum, or acids in water treatment where precise accuracy is required, consult the literature of Precision Chemical Pump Corp., 1396 Main St., Waltham 54, Mass.

Power Packer and Sani-Tainer Refuse Collection Methods

272. A 4-page bulletin on the Power Packer refuse collection bodies and the Sani-Tainer refuse containers for municipalities is available from Daybrook Hydraulic Div., Young Spring & Wire Corp., Bowling Green, Ohio.

Ten New Testing Apparatus for Highway Materials and Construction

312. Included in the new items are apparatus for concrete, soils and asphalt testing, and the Beggs Deformeter for solving problems involved in the design of indeterminate structures. Check the reply card or write to Solitest, Inc., 4711 W. North Ave., Chicago 39, Ill.

WATER WORKS

In-Place Cement Lining of Small and Large Pipe

25. A catalog describing a process of in-place centrifugal cement lining of pipes from 4 to 144 ins. in diameter is available from the CentriLine Corp., Raymond International Inc., 140 Cedar St., New York 6, N. Y. Check the reply card for sample specifications and test results.

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg. Co., Erie, Pa. Check the reply card.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Building a Giant Water Line

157. Construction of a 14-ft. diameter steel water line in Pennsylvania is described in this 4-color, 4-page bulletin available from Bethlehem Steel Co., Bethlehem, Pa. Check the reply card.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick flocculation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Telemetering Links Transmitter and Receiver Over Any Distance

102. Bulletin #230-P4 describes how Builders-Providence Chronoflo telemeters enable users to observe and record the operation of widely scattered meters at a central location from any distance. Check the reply card or write B-I-F Industries, Inc., 345 Harris Ave., Providence 1, R. I.

Right Angle Gear Drive and Deep Well Turbine Pump

107. Applications, gear drive selection tables, pulley data, efficiencies and standard dimensions of Johnson right angle gear drives are covered in catalog from Johnson Gear & Mfg. Co., Ltd., Eighth and Parker Sts., Berkeley 10, Calif. Check the reply card.

Catalog on Industrial and Motor Controls

143. Catalog illustrates and describes B/W magnetic contactors, starters and reversing contactors, together with diagrams of enclosures and dimensions. Copies are available from B/W Controller Corp., 2211 East Maple Road, Birmingham, Mich., or check the reply card.

HAVE YOU STOPPED TO THINK ABOUT SAFETY IN SIGNS?



Signs made to control traffic have to be seen and read — day in, day out, year after year. That's why you're safe when you install Miro-Flex signs. They are embossed for greater strength, rigidity, and legibility. Because they are made on zinc-coated, Bonderized steel, and finished with high-grade, baked-on enamel, they still do their duty years after ordinary signs have been replaced. A complete line of Uniform Traffic-Control Signs, Street-Name Assemblies, and custom-designed signs are available. Write for free catalog.

Embossed MIRO-FLEX SIGNS LAST and LAST...



STOP



NO PARKING
LOADING
ZONE



SPEED
LIMIT
55



SLOW



SCHOOL
15 MPH



LINCOLN
SHERIDAN

THE **MIRO-FLEX** CO., INC.

1824 EAST SECOND

WICHITA 7, KANSAS

Standard Traffic Signs Available for Immediate Delivery at Northeastern Warehouse

Keontz Equipment Corporation, 325 Ohio River Blvd., Emsworth, Pittsburgh 2, Pennsylvania

*" - - and I'm pleased to note
that since we've instituted your
rodent control program we have
not seen one single - - "*



IT'S AS EASY AS THIS

- EACH ITEM HAS A NUMBER
- DECIDE ON WHICH ITEMS YOU WANT MORE DATA
- CIRCLE THE CORRESPONDING NUMBERS ON THE CARD
- SIGN THE CARD, AND MAIL. NO POSTAGE IS NEEDED
- PUBLIC WORKS WILL MAKE SURE YOUR REQUESTS ARE FILLED

November 1959

USE THIS CARD to get detailed information

Please send me literature on the following items described in PUBLIC WORKS:

Readers' Service Booklets Appear on Pages 32 to 48

20 25 29 36 37 38 39 42 43 49 50 58 59 62 63 64 68 69 71 73 75 79 83 84 88 97 99 101 102
107 109 113 119 120 124 131 135 142 143 146 149 150 153 154 155 156 157 159 160 161 162 163 164 165 169 170 173 178
179 180 182 183 184 185 187 188 192 197 199 200 206 207 208 211 214 215 220 222 224 228 231 243 247 249 254 256 257
260 262 263 267 270 271 272 283 284 285 288 292 294 296 298 305 306 309 312 316 320 329 331 346 347 352 366 376 379
381 386 404 409 414 429 430 438 440 448 455 473 484 493 496 502 503 511 530 534 535 538 540 551 562 565 566 586 588
601 610 620 623 647 660 664 665 668 673 677 681 689 696 713

New Equipment Items Appear on Pages 171 to 177

11-1 11-2 11-3 11-4 11-5 11-6 11-7 11-8 11-9 11-10 11-11 11-12 11-13 11-14 11-15
11-16 11-17 11-18 11-19 11-20 11-21 11-22 11-23 11-24 11-25 11-26 11-27 11-28 11-29 11-30
11-31 11-32 11-33 11-34

Name (Please Print) _____
Occupation _____
Street _____
City _____ State _____

NOT GOOD AFTER DEC. 15, 1959

**Save time,
and effort
by using this
reply card.**

Meetings and Conventions

- Virginia Section, AWWA**
Roanoke, Va., Nov. 4-6
- Nebraska Section, FSIWA**
Sidney, Nebr., Nov. 5-6
- South Carolina Section, FSIWA**
Columbia, S. C., Nov. 6
- North Carolina Section, AWWA**
Durham, N. C., Nov. 9-11
- Florida Sections, AWWA and FSIWA**
Tampa, Fla., Nov. 15-19
- Oklahoma Section, FSIWA**
Stillwater, Okla., Nov. 16-20
- Indiana Section, FSIWA**
Indianapolis, Ind., Nov. 18-19
- American Society of Mechanical Engineers**
Atlantic City, N. J., Nov. 29-Dec. 4
- Course on "Chemical Analyses for Water Quality"**
Cincinnati, Ohio, Nov. 30-Dec. 11
- Highway Research Board**
Sheraton-Park Hotel
Washington, D. C., Jan. 11-15, 1960
- American Road Builders' Assn.**
Cincinnati, Ohio, Jan. 18-20, 1960
- New York Section, FSIWA**
New York, N. Y., Jan. 20-22, 1960
- Associated Equipment Distributors**
Conrad Hilton Hotel
Chicago, Ill., Jan. 24-28, 1960
- Indiana Section, AWWA**
Indianapolis, Ind., Feb. 3-5, 1960
- Illinois Section, AWWA**
Chicago, Ill., Mar. 16-18, 1960
- New England Section, AWWA**
Boston, Mass., Mar. 17, 1960
- Southeastern Section, AWWA**
Savannah, Ga., Mar. 20-23, 1960
- West Virginia Section, FSIWA**
Huntington, W. Va., Mar. 23-24, 1960
- New Jersey Section, FSIWA**
Atlantic City, N. J., Mar. 30-Apr. 1, 1960
- Association of Highway Officials of the North Atlantic States**
Bellvue-Stratford Hotel
Philadelphia, Pa., Mar. 30-Apr. 1, 1960
- New York Section, AWWA**
Binghamton, N. Y., Apr. 5-7, 1960
- Nebraska Section, AWWA**
Lincoln, Nebr., Apr. 20-22, 1960
- Kansas Section, AWWA**
Emporia, Kan., Apr. 20-22, 1960
- California Section, AWWA**
Monterey, Calif., Apr. 22, 1960
- Kansas Section, FSIWA**
Emporia, Kan., Apr. 22-24, 1960
- Montana Sections, AWWA and FSIWA**
Billings, Mont., Apr. 28-30, 1960
- Pacific Northwest Section, AWWA**
Portland, Ore., May 4-6, 1960
- American Water Works Assn.**
Americana Hotel
Bal Harbour, Fla., May 15-20, 1960
- Central States Section, FSIWA**
Madison, Wisc., June 15-17, 1960
- Institute of Traffic Engineers**
Edgewater Beach Hotel
Chicago, Ill., Sept. 11-15, 1960
- Kentucky-Tennessee Section, FSIWA**
Knoxville, Tenn., Sept. 11-15, 1960
- Missouri Section, FSIWA**
Jefferson City, Mo., Sept. 25-27, 1960
- New York Section, AWWA**
Whiteface, N. Y., Sept. 28-30, 1960
- Federation of Sewage and Industrial Wastes Associations**
Philadelphia Sheraton Hotel
Philadelphia, Pa., Oct. 2-6, 1960
- Southwest Section, AWWA**
Galveston, Tex., Oct. 16-19, 1960
- California Section, AWWA**
Long Beach, Calif., Oct. 25-28, 1960

BUSINESS REPLY CARD

No Postage Stamp Necessary if Mailed in the United States

PUBLIC WORKS Publications

200 South Broad Street

Ridgewood, New Jersey

Readers' Service Dept.

FIRST CLASS

PERMIT No. 7

RIDGEWOOD, N. J.

SEALED FOREVER AGAINST DIRT, WATER AND FOGGED REGISTER DIALS

The Rockwell Sealed Register meter *alone* has all the registering mechanism and all the reduction gearing encased in a steel and glass housing. Nothing can pass this hermetically sealed barrier to cause wear or corrosion. And, since the register operates high and dry above the flowing stream, condensation under the glass just can't occur.

In this revolutionary meter, a simple, powerful magnetic drive transmits motion from the measuring chamber to the sealed register without mechanical linkage. There's no stuffing box to leak or bind—and only two moving parts operating in water. With this construction service troubles are a thing of the past, while maintenance costs go way down. Get full facts now. Write Rockwell Manufacturing Co., Pittsburgh 8, Pa.



Now available
in both 5/8"
and full 3/4" sizes



SEALED REGISTER METERS

another fine product by

ROCKWELL



To order these helpful booklets check the reply card opposite page 34.

Meter Features That Help Make Water Works Profitable

89. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American Water meters described in Bulletin No. 56 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Check the reply card.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2 1/2" to 14 1/2" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydratrac Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Guide Book Information for Emergency Power

153. This book covers what to do when commercial power fails in a fire, flood, hurricane, war and other national disasters. Check the reply card or write Caterpillar Tractor Co., Engine Div., Peoria, Ill., for a copy of "The Four Horsemen of the Space Age."

AWWA Fire Hydrants and Gate Valves

185. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking reply card.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

Valve and Hydrant Construction Details

141. A 72-page catalog-type bulletin, just completed, gives detailed data on construction and application of gate valves, check valves and hydrants for water works service. Write for Bulletin 5710 from Darling Valve and Mfg. Co., Williamsport, Pa., or check the reply card.

For Prompt Service Use The Reply Card

Now Every Municipality Can Own a Trencher

173. The low cost of the ARPS Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

Lay Water Mains Faster With "Fluid-Tite" Couplings

184. Get permanent water-tight joints automatically with K & M "Fluid-Tite" couplings for K & M asbestos-cement pressure pipe. Full details on this faster installation and self-energizing couplings are available from Keesbey & Mattison Co., Ambler, Penna.

Manual on Filter Bed Agitators

206. General information—specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

Meters and Instruments For Water Works

224. An attractively arranged 20-page booklet issued by Sparling Meter Co., 225 No. Temple City Blvd., El Monte, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. The larger model is available with air power unit to eliminate manual pushing. Get full details by checking the reply card. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

Pipe Cutter for Cutting Large Size Pipe

254. An all-purpose pipe cutter that can cut pipe in or out of the ditch is described in a bulletin available from Ellis & Ford Mfg. Co., P. O. Box 308, Birmingham, Mich. Check the reply card for sizes and parts list.

Concrete Admixtures and Joint Sealers

346. Retarding and accelerating densifiers for concrete and mortar, coatings for exposed aggregate concrete, non-metallic mastic water-stops and quicksetting products are covered in 8-page bulletin available from Sika Chemical Corp., 29-49 Gregory Ave., Passaic, N. J.

FOR
UTILITIES
and
GOVERNMENT
AGENCIES

DE-WATERING PROBLEMS LICKED with FLYGT Submersible Electric Pumps

Public Utilities and Government Agencies throughout the world find FLYGT SUBMERSIBLE ELECTRIC PUMPS tops in performance on any de-watering problem. Public Works users like FLYGT foolproof features, the advantage that the pumps work in any position, and the fact that they do not clog up. They can take a lot of solid stuff like mud and sand without hurting them in any way. The rubberized pump casings and hard chrome alloy impellers combine to make FLYGT PUMPS rugged equipment which works 24 hours a day with little or no attention. Low in initial cost . . . low in operating expense, FLYGT PUMPS will save you money.

FLYGT SUBMERSIBLE ELECTRIC PUMPS range in size from 1 1/2"-85 GPM capacity to 8"-3000 GPM capacity. Head capacities range up to 210 feet. Higher heads obtainable with FLYGT PUMPS in tandem. Weights range from 70 to 1200 pounds. Write for complete specifications.



CHECK THESE FLYGT FEATURES

- ✓ Electric, fully submersible, fully portable.
- ✓ Instant pumping — no priming, no installation.
- ✓ Runs dry without damage, resistant to salt water.
- ✓ Takes a high proportion of solids, frost and fire-proof.
- ✓ Practically no maintenance or supervision.
- ✓ Operates unattended, quick and easy to service.

ASK FOR NAME OF NEAREST DEALER

FLYGT

WEST OF THE MISSISSIPPI:

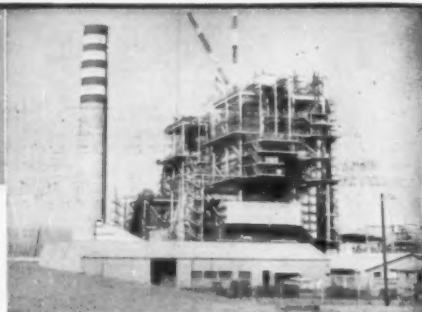
EAST OF THE MISSISSIPPI:

Stanco
MFG. & SALES INC.

1656 Ninth St.
(Corner of Olympic & Ninth)
Santa Monica, California.

**STENBERG
MANUFACTURING
CORPORATION**

Hoosick Falls, N.Y.



Near Los Angeles, California, the immense Steam Generating Plant illustrated above produces more electricity than Hoover Dam, and when completed it will be one of the major sources of electric power in the entire West. This plant uses two FLYGT models B-80 and one B-38L for a variety of around-the-clock de-watering applications. Operating at the bottoms of sumps and excavations, the FLYGT PUMPS keep strategic areas free of salt-water intrusion and seepage from storm water run off. The FLYGTs often pump a high proportion of solids, and have proven resistant to salt water.

To order these helpful booklets check the reply card opposite page 34.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Bell and Spigot Joint Leaks Quickly Repaired

214. Broken water main can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Leaky bell and spigot joints are made lastingly tight with Skinner-Seal Bell Joint Clamps. Get Skinner Catalog GW now—this handsome 48-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. M. B. Skinner & Co., South Bend 21, Ind.

Review of Diatomite Filtration of Water

285. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Diatomite Department, 612 So. Flower St., Los Angeles 17, Calif. for Bulletin BW-13 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

Quick Review of Water Meters

316. A helpful condensed catalog which covers sizes and types of water meters for every kind of service is available from Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa. Each type is illustrated and fully described; specifications and prices are included. Get Bulletin W-800 by checking the reply card.

Manual on the Hershey Disc Water Meter

329. Illustrations, descriptions and specifications of Hershey water meters are covered in manual available from Hershey Mfg. Co., 230 Elm St., Dedham, Mass. Size ranges are 1/2"-1/4"x1/4"-1/4" and 1". Check the reply card.

Portable, Standby Or Continuous Power

440. Generators and power plants for emergency, portable continuous power are described fully in literature available from Katolight Corporation, Box 89-107, Mankato, Minnesota. Information on motor generator sets, high frequency changers and independent generators up to 400 K. W. is included.

V-Notch Chlorinator For Chlorine Flow Control

502. An 8-page catalog on the W & T Series A-721 chlorinator is available from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Chlorinator is adaptable to any type of chlorinator control and feed rate may be controlled manually or automatically.

Air Control Valves For All Types of Pipelines

620. Literature on Crispin Air Valves, which safely control air in lines handling liquids, to maintain efficient operation and prevent expensive failures, is available from Multiplex Manufacturing Company, Dept. C, Berwick, Pa. Write today for your copy of the Crispin Air Valve Catalog, which offers complete information on the full line of dependable Crispin Air Valves.

Bulletin Covers Step-by-Step Action on the Water Problem

689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, East Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

Gas and Gasoline

Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wis., for details on the use of these engines in compressor, generator and pumping installations.

Modern Elevated Water Tanks

566. A 16-page bulletin describing 2 types of water storage tanks, the watersphere and the waterspheroid, is available from the Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago 4, Ill. Standard sizes from 25,000 gals. to 500,000 gals. are covered.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Mueller Drilling, Tapping and Inserting Machine

696. The Mueller B-100 double pressure chamber tapping machine makes faster taps, assures pressure tight connections and can be used by hand or with power. Check the reply card or write Mueller Co., Decatur, Ill.

REFUSE COLLECTION AND DISPOSAL

Reduce Your Refuse Disposal Costs

150. A complete line of refuse disposal systems that include containers, giant containers, compaction bodies and compaction trailers are described in literature from Demester Brothers, Dept. PW, Knoxville 17, Tenn. Check the reply card for data on these efficient systems.

Versatility, Compaction Force Account For Extra Packer Capacity

159. The many advantages of this modern packer unit have been combined into a fact-filled bulletin entitled "The Big Squeeze" which is available from E-Z Pack Div., Hercules Gallon Products, Inc., Gallon, O.

Load-Packer 600 Points the Way to the Best in Refuse Collection

188. Bulletin W-200 explains how the Gar Wood Load-Packer gives faster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card for full details.

Bulk Refuse Collection with Super Roto-Can

192. A bulletin describing the bulk refuse system called the City Tank Roto-Can, which provides an unusual flexibility of service and the handling of all types of trash, is available from City Tank Corp., Corona, N. Y. Check the reply card.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Methods and Benefits of Sanitary Landfill

409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis.



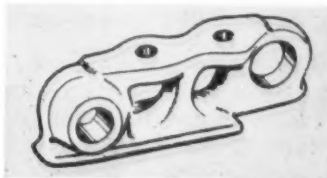
Even "the toughest track ever made" (Allis-Chalmers, of course) needs adjustment to give you the extra life that's built into it. Make this on-the-job track check.

Take a pry bar and see how far you can raise the track above one of the support rollers. More than two inches means it's too loose. Take up the slack, move the tractor back and forth to equalize the tension, then check again.

Regular track inspection is an easy way to make sure you get the most out of "the toughest track ever made."

WHAT toughest REALLY MEANS

It's more than just talk. Take sidebars, for instance. Some track makers get by with mere surface hardening, which sacrifices wearing quality for easier machining. But Allis-Chalmers deep-hardens the forged steel, leaving a tough inner core for high impact strength. Then, pin and bushing bores only are annealed, and the superhard sidebar is machined to precise finish dimensions.



The moral of the story: Stay on the right track—"the toughest track ever made." Get original-quality parts from your Allis-Chalmers dealer.

move ahead with
ALLIS-CHALMERS
power for a growing world



Chicago

Congress Expressway Project Sewer Lines **made WATERTIGHT with PRESS-SEAL!**

Approximately 11,000 feet of 60" to 72" concrete sewer pipes were fitted with Press-Seal rubber gaskets to provide the Windy City with permanently water-tight sewer lines along the Congress Expressway.

Press-Seal *confined compression type* gaskets are fitted quickly to the ends of concrete pipe sections before they are laid. Installation is fast and accurate, providing permanent protection against leakage in all types of soil.

Press-Seal gaskets are vulcanized from a special high quality Goodyear compound that lasts as long as the concrete pipes they seal. Savings on installation time and cost are substantial.

Detailed engineering data on request. Send, if you wish, information about your special problems. Suggestions will be sent at no cost to you. Write today.

Contractor: Kenny Construction Company, Skokie, Illinois.

Construction Engineer: District 1, State of Illinois, Mr. McGowan.

Pipe supplied by American Marietta Co., Concrete Products Division, Hodgkins, Illinois.

PRESS-SEAL

- Prevents Infiltration
- Speeds Installation
- Stops Root Problems
- Cuts Installation Costs
- Reduces Accidents
- Permits Pipe-line Contraction and Expansion

Available in different types of gasket material for every sewerage purpose: Buna-N for Oil Content Sewage, Neoprene for Acid Content Sewage, Natural Rubber for Common Sewage.



MANUFACTURED EXCLUSIVELY BY

PRESS-SEAL GASKET CORP.

OFFICE AND PLANT: P. O. BOX 482, R.R. 4, COVINGTON RD.

FORT WAYNE, INDIANA • Phone Kenmore 5213



PRESS-SEAL GASKET OF CALIFORNIA—P.O. BOX 3054, SANTA BARBARA, CALIFORNIA
PRESS-SEAL GASKET CORPORATION OF CANADA—KITCHENER, ONTARIO

To order these helpful booklets check the reply card opposite page 34.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Filter Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement-tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

Sewer Design Flow Chart Based on Manning Formula

154. A large-scale, convenient flow chart based on the Manning formula, together with typical examples of use, is available from John-Manville, 22 East 40th St., New York 16, N. Y. To get your copy check the reply card or write to the manufacturer and ask for Bulletin TR-94A.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Manual on Sewer Structures

178. This is a 48-page manual on installation design, reference data and graphs showing discharge of pipe based on Manning's formulas. Also such subjects as structural durability, material durability; selection of structures; factors influencing capacity; joints and fittings; and linings for failing sewers are covered. Copies of Manual CMS-7456 are available from the Product Information Service, Armo Drainage & Metal Products, Inc., Middletown, Ohio, or by checking the reply card.

Packaged Underground Lift Station

124. Selection tables and detailed drawings of 1 packaged underground lift stations with "Fluan-Kleen" sewage pumps are available in literature from Chicago Pump Co., 622 Diversey Parkway, Chicago 4, Ill. Check the reply card today.

Catalog on the Flynn and Emrich Incinerator Stokers

180. This catalog describes the Flynn and Emrich incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check reply card for catalog No. 1702 from Flynn and Emrich Co., Holiday and Saratoga Sts., Baltimore 2, Md.

Specification Manual on the Hapman Tubular Conveyors

187. How to specify Hapman tubular conveyors for use with grit and filter cake including storage hopper, supporting structure and freeze-up protection are contents of this manual. For your copy check the reply card or write Stuart Corp., 516 North Charles St., Baltimore 1, Md.

Literature on Concrete Sewers

270. Literature on concrete sewers is available from Portland Cement Association, Dept. 10-89, 33 West Grand Ave., Chicago 10, Ill. Check the reply card for data on concrete for all modern pipelines.

A New and Better Method of Burning Refuse

296. Advantages of incineration, industrial application, firing methods, design and performance of the C-E incinerator stoker are explained in literature. Check the reply card or write Combustion Engineering, Inc., Combustion Engineering Building, 200 Madison Ave., New York, N. Y.

Amvit Mechanical Jointed Clay Pipe

298. The new Amvit jointed vitrified clay pipe in sizes 4 through 24 inches with the true "built in" mechanical joint ready for immediate and easy installation is infiltration and root-proof. Offers better flow and less maintenance and permits deflection and absorbs shocks. It is furnished on all standard fittings and permits immediate backfilling and testing. For literature write to American Vitrified Products Co., National City Bank Building, Cleveland, Ohio, or check the reply card.

Gravity Sewer Pipe Engineering Classifications

305. A quick method for choosing the most economical class of asbestos-cement sewer pipe to suit each laying condition with handy crushing table based on the Marston formula is available from Keasbey & Mattison Co., Ambler, Penna. Check the reply card.

Plunger Pumps of Heavy Duty Design

309. Plunger pumps, simplex, duplex, and triplex of heavy duty design including dual valves and improved reduction gear mechanisms are covered in bulletin KSP-3 which gives selection charts and application data and is available from Komline-Sanderson Engineering Corp., Peapack, N. J., or by checking the reply card.

Eimco-Process Flotators and Auxiliary Equipment

381. An 8-page two color bulletin describing flotation systems that are designed to accomplish difficult liquid-solids separations in the treatment of industrial wastes and domestic sewage is available from Process Engineers, Inc., Div. of The Eimco Corp., 634 South Fourth West St., Salt Lake City, Utah.

Clean Sewers With the O'Brien Sewerking

484. The O'Brien Sewerking operates completely by power in cleaning sewers and for full information write O'Brien Mfg. Corp., 5662 Northwest Highway, Chicago 30, Ill. Check the reply card to find out how power rotates cable and cutting tool and how power transmission drives cable forward or reverse.

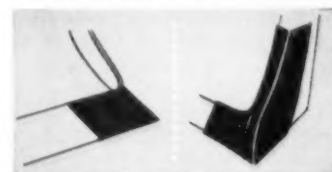


Don't kid yourself! An extra half inch of wear on the cutting edge of your dirt-mover can cost you plenty! Wear that chews into the moldboard weakens it—especially around bolt holes. Then you may have to rebuild or even replace the whole works!

Renew or replace cutting edges and bits before moldboard wear starts. You'll be money ahead on repairs and 'way out front in dirt-moving efficiency.

ONLY THE BEST IS A BARGAIN!

Speaking of moving dirt, Allis-Chalmers really has the edge! Take dozers, for instance. Cutting edges and end bits are made of finest alloy steel, forged and electronically heat-treated in a process that deep-hardens working faces for extra-long wear, toughens the core to resist impact. For rock-doing or worse, Allis-Chalmers makes heavy-duty edges, end bits and wrap-around end bits.



The man from your Allis-Chalmers dealer knows all about moldboards—for a new machine or reconditioning one you own—and the edges he recommends are right. Whatever you need, get original-quality Allis-Chalmers parts—made for the machine, best for the job.

move ahead with
ALLIS-CHALMERS
power for a growing world



To order these helpful booklets check the reply card opposite page 34.



In the background, a section of the new filtration plant at Miami, Fla. Thoroseal protects all its masonry.

Specify Thoroseal

Thoroseal is not a thin paint. It is a cement-based product which goes on in a heavy coat and actually becomes a part of the masonry beneath it and positively seals it against the erosion and penetration of moisture. It goes on quickly and easily—especially with our new wide brush technique. It pays to remember that when you are protecting masonry, the best product is always the least expensive. Standard Dry Wall has been in business since 1912. Its products speak for themselves.



Please send me your free new specification guide.

Name

Address

City Zone State

Standard Dry Wall Products, Inc.

Box X (5) New Eagle, Pa.

Plants at New Eagle, Pennsylvania and Centerville, Indiana

Torque-Flow Sewage Pump For All Phases of Sewage Treatment

496. Bulletin No. P10-B26 describes the operation of the Wemco torque-flow sewage pump and covers typical installation set-ups. Check the reply card or write Western Machinery Co., 650 Fifth St., San Francisco, Calif., for complete details.

Complete Treatment Unit for Handling Flows to 0.5 MGD

503. Developed for sewage flow characteristics of small communities, the Activator-Clarifier is a complete treatment unit utilizing automatic balance of activated sludge solids with sewage flow. Bulletin 129, issued by the Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill., describes application of this unit. Check the reply card.

Sewage Treatment Engineering Data Manual

511. This manual contains a brief outline of the various accepted methods of treating sewage and some of the problems, advantages and disadvantages of each. Check the reply card or write Smith & Loveless, Inc., P. O. Box 8884, Kansas City 15, Mo., for design notes, charts and drawings.

4-D Wrought Iron for Building Drainage Systems

551. A comprehensive 64-page catalog on piping for soil, waste, vent and downspout applications is available from A. M. Byers Co., P. O. Box 1076, Pittsburgh 30, Pa. Check the reply card for corrosive conditions, typical installation, performance tables and piping economy.

Book Describing Methods of Aggregate Preparation

565. A 40-page book describing methods of aggregate preparation, beneficiation and handling has been prepared by Wemco Products Div., Western Machinery Co., 650 Fifth St., San Francisco 7, Calif. Check the reply card for complete engineering data.

Use The Reply Card

Sewer Cleaning Service By National Power Rodding

601. N.P.R.C. has mobile-mounted equipment and trained personnel ready at all times for routine sewer cleaning jobs or specialized service. Write National Power Rodding Corp., 1000 South Western Ave., Chicago 12, Ill., or check the reply card for services available from this company.

Press-Seal Rubber Gaskets to Seal Joints of Concrete Pipe Sewers

623. Rubber gaskets for sealing the joints of concrete sewer pipe are described fully in literature available from Press-Seal Corp., P. O. Box 482, Fort Wayne, Ind. Check the reply card for information on how these gaskets prevent water infiltration in sewer lines.

Roots-Connersville Rotary Gas Meters

644. Bulletin M-258 covers complete data on R.C. rotary positive displacement meters. Check the reply card or write Roots-Connersville Blower Div. of Dresser Industries, Inc., 559 Poplar Ave., Connersville, Ind., for your copy.

Catalog on Steel Grating

645. New ideas in flooring, walkways, stair treads, platforms and shelving are covered in Catalog 2527R available from Blaw-Knox Co., Dept. W., Pittsburgh 38, Pa. Check the reply card for information on choice of cross bar and bearing bar designs and spacings.

Full Line of Sewer Cleaning Equipment

681. Everything for rodding sewers from hand operated equipment to the fully mechanized SewerRoder. Tools for all types of stoppages are operated by Flexicrome Steel Sewer Rods. Featuring the Truck-Loder which dumps sewer deposits directly into truck, a complete range of Bucket Machines is offered. All equipment is described in 48-page Catalog 55-A. Flexible, Inc., 3786 Durango Ave., Los Angeles 34, Calif.



Atlantic City's Newest Convention Hotel

The Jefferson with its new facilities for handling all convention groups is fast becoming Atlantic City's most popular convention hotel.

The Jefferson features an abundance of Meeting, Banquet and Exhibition Rooms fully equipped to handle your every need. Experienced personnel. Location ideal in heart of Atlantic City.

WRITE • PHONE • WIRE TODAY
FOR DESCRIPTIVE LITERATURE

Convention Manager
Hotel Jefferson
Atlantic City, N. J.



TOO BUSY

to give up a few hours a year
for a health checkup?

Your best cancer insurance is
a thorough checkup every year,
and alertness to Cancer's 7
Danger Signals.

Learn how to guard yourself
against cancer. Write to
"Cancer" in care of your
local post office, or call your
nearest office of...

American Cancer Society

STREETS AND HIGHWAYS

Automatic Sample Driver For Sub-Surface Exploration

49. This compact portable drilling unit features augering, driving and core drilling for sub-surface exploration. Check the reply card or write Penn-drill Mfg. Div., Pennsylvania Drilling Co., 1201-1205 Chartiers Ave., Pittsburgh 20, Pa., for full information.

Concrete Bridge Details

58. An illustrated 48-page booklet, published by the Portland Cement Association, 33 W. Grand Ave., Chicago 10, Ill., calls attention to good and poor practice in bridge building. It also shows how to improve improper details and open the way for use of higher stresses. Write to PCA for your copy or check the reply card.

Soil Sampling Equipment for Dams, Bridges, Highways and Airports

142. Bulletin 300, available from Sprague & Herwood, Inc., Scranton 2, Pa., illustrates and describes their complete line of soil sampling equipment and their Model PD & PDH soil sampling rigs. Check the reply card for data on sampling equipment.

Plywood Signs For Expressway Signing

149. Crezon overlaid plywood signs will withstand the worst weather and will not check, split or bend or tear loose from the pole. Check the reply card or write Crown Zellerbach, San Francisco 19, Calif., for complete data on this signing material.

Chip Dollars from Your Overhead With Fitchburg Chippers

160. Detailed cutaway drawings, specifications, diagrams, charts and money-saving reports and experiences are covered in catalog available from Fitchburg Engineering Corp., Dept. FW, Fitchburg, Mass.

Damaged Barricades Can Be Repaired With PM Barricade Kits

163. PM barricade kits provide a flexible replacement system for damaged barricades. Check the reply card or write Pacific Mercury, 13232 Leadwell, No. Hollywood 9, Calif., for details on PM transistor neon or incandescent flasher warning lights.

Modern Compaction Methods and Equipment

200. This 52-page Manual covers modern day compaction methods and equipment, rubber-tire rolling, compaction of asphalt mixes, aspects of vibratory compaction, stage compaction on cohesive soils and compaction of asphaltic concrete surfaces. Check the reply card or write Road Machinery Div., Bros Inc., 1057 Tenth Ave., S. E., Minneapolis 14, Minn., for your copy.

1½ Cu. Yd. Tractor Shovel for Standout Performance

208. The Trojan 124 has 10,000 lb. rated lifting capacity, power shift transmission and 40" bucket tip at carry position. For literature write to Trojan Div., The Yale & Towne Mfg. Co., Batavia, New York.

All-New Transistorized Mobile Radio

243. General Electric's complete, new transistorized mobile radios are available in 10, 30 and 75-watt ratings, 150-174 mc. The design of these units permit front-mounting in any make or model car or truck. For catalog on specifications, models and operation write to General Electric Co., Communication Products Dept., Lynchburg, Va.

Highway Pavement Marking Equipment

347. Strippers that are capable of applying single, double or two-color triple line stripes are described in literature from Kelly-Creswell Co., Xenia, Ohio. Machines are truck-mounted or self-propelled. Check the reply card.

how much for a mud overcoat?



A thick mud overcoat on your tractor engine could cost you more than mink! Mud acts like insulation, impairs cooling of exposed surfaces—and you may be heading for an expensive overhaul. In any case, overheating steals power, spoils lube oil and cooks the life out of engines.

Hose the day's mud off. Clear away dirt or brush—especially around the engine and radiator. This not only helps cooling, it may also uncover trouble before it starts costing you money!

KEEP IT CLEAN INSIDE, TOO!

Efficient filter protection keeps Allis-Chalmers engines clean *inside*. Large fuel filters, full-flow oil filters and oil bath air cleaner with pre-cleaner are on guard against all kinds of sneaky, wear-causing dirt particles you might never see.



Help your engine live a long, healthy life. Service filters regularly and replace elements at recommended intervals. The service expert from your Allis-Chalmers dealer knows best replacement periods for any conditions. See him for genuine Allis-Chalmers replacement filters—*made for the machine, best for the job.*

move ahead with
ALLIS-CHALMERS
power for a growing world



To order these helpful booklets check the reply card opposite page 34.

Illustrated Specifications on Brush and Limb Disposal

223. A new booklet on the modern approach to the brush problem shows how an Asplundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asplundh Chipper Company, 505 York Road, Jenkintown, Pa., or use the handy reply card.

Monthly Time and Cost Record Book

249. To assist owners in determining the cost of owning and operating equipment Caterpillar Tractor Co., News Service, Peoria, Ill., has prepared a 24-page monthly time and cost record book. Twelve sets of pages are included on which to record day by day machine expenses for an entire year. Check the reply card for your copy.

Reinforced Concrete Cribbing for Highways and Embankments

267. Typical wall sections and details of standard units of open or closed face concrete cribbing are covered in catalog from American-Marietta Co., Concrete Products Div., American-Marietta Bldg., 101 East Ontario St., Chicago 11, Ill. Check the reply card for general specifications and installation of the cribbing.

Hand Operated Soil Sampling Kit

366. Bulletin 26-R describes the Acker soil sampling kit that contains 12 different soil sampling tools packed in a handy steel case. Check the reply card or write to Acker Drill Co., Inc., P.O. Box 830, Scranton 2, Pa., for data on tools that are designed to take soil samples from practically any material.

Tractor-Shovels With Drott "Four-In-One" Attachment

352. Hough rubber-tired front-end loaders come equipped with the Drott "4-in-1" bucket. Check the reply card or write The Frank G. Hough Co., Libertyville, Ill., for literature on how to use this unit as a shovel, clamshell, scraper and bulldozer.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midjet ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4 1/2 feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

64-Page Manual On Surface Treatments

484. Complete up-to-the-minute information on all types of surface treatments is covered in manual available from American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif. The Manual provides on-job reference as well as engineering department use and it covers every step from pavement inspection to traffic control on the finished pavement. Check the reply card.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Prestressed Concrete in Your Construction Needs

647. Prestressed beams, slabs and girders for bridges are covered in information available from American Steel & Wire, Rockefeller Bldg., Cleveland 13, Ohio. Check the reply card for complete details.

Manual on Highway Railings For Bridges and Roadways

660. This manual covers design suggestions, comments, specifications for design and construction and the advantages of Alcoa aluminum alloy highway railings. Check the reply card or write Aluminum Company of America, Alcoa Bldg., Pittsburgh 19, Pa., for this valuable manual.

STREET LIGHTING AND TRAFFIC CONTROL

Tomorrow's Lighting on Today's Streets

79. Bulletin GEA-6989, 12 pages, illustrates how several cities, both large and small, met the challenge of poorly lighted downtown areas. Check the reply card or write General Electric Co., Schenectady 5, N. Y., for data on mercury, fluorescents and filament lighting luminaires.

Non-Electric Traffic Control Products

156. Reflective pavement marking glass beads, Catalflex "202" reflective coating, Cataline reflective striping, Catatherm reflective plastic striping, plain and reflective street and highway signs, plain and reflective street name signs are covered in literature from Cataphote Corp., P. O. Box 2066, Jackson, Miss.

Residential Street Lighting

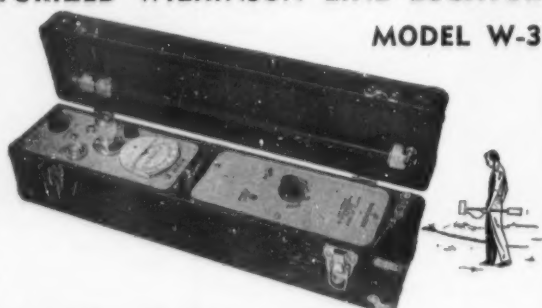
228. A new 16-page bulletin on residential street lighting is now available from the General Electric Co., Schenectady 5, N. Y. Well illustrated, the bulletin, designated GEA-6316, explains how good lighting benefits a residential community and provides information on how to plan modern residential lighting installations.

NEW MINIATURIZED WILKINSON LINE LOCATOR

Radically new, powerful, transistorized locating instrument weighs only 4 lbs. and is 1/4 as large as old type pipe locators.

Telescoping aluminum handle; 2 oz. single ear set; all in carrying case.

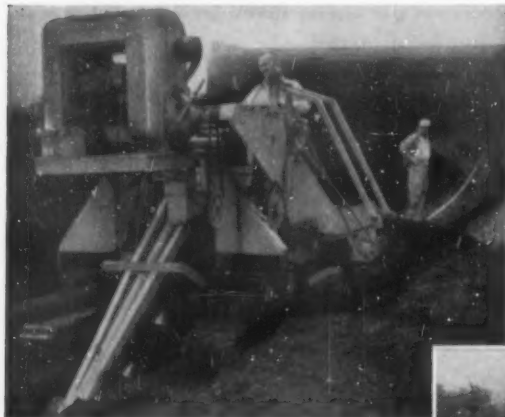
Write today for brochure and instruction manual.



WILKINSON PRODUCTS COMPANY

3987 Chevy Chase Dr., Pasadena 3, Calif.

SYLvan 0-4314



Rugged, Inexpensive VERMEER POW-R-DITCHERS

If one of your problems is low-cost, time-saving trenching and ditching... take a look at the VERMEER POW-R-DITCHER line before you buy! The 524T (above) digs 8" to 24" wide. The 4T (right) digs 6" to 14" wide. Both are fast, rugged, self-propelled and low in price. Ideal for digging foundation footings, gas, water, sewage and service lines. A third smaller unit also available.

Write For Literature and Low
Prices On The Complete Line

VERMEER MANUFACTURING COMPANY
1439 W. WASHINGTON PELLA, IOWA

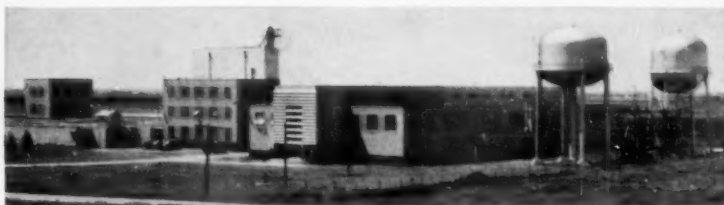
Which Size For YOU?



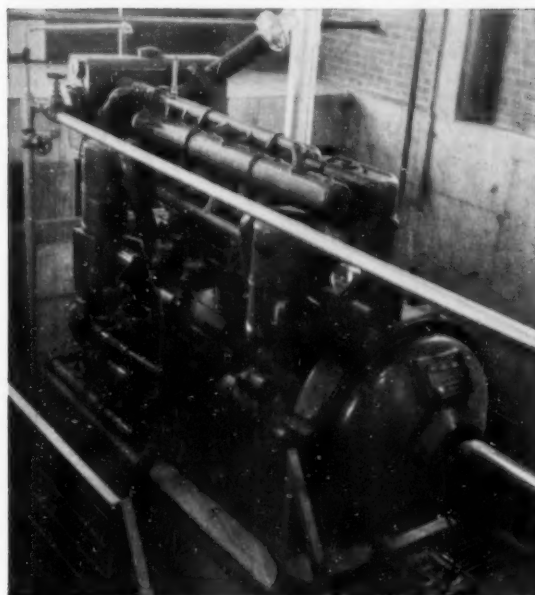


• The trade mark LE ROI is used under license from Westinghouse Airbrake Co., the trade mark owner.

POWER FOR MUNICIPAL PLANTS

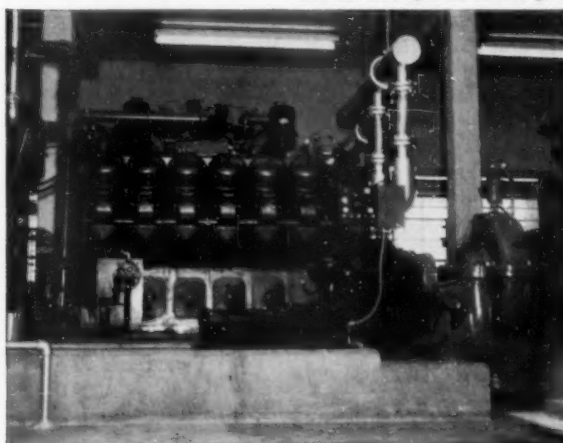


Three ROILINES pull the pumps at Oklahoma City's Lake Hefner Municipal Filtration Plant.



Model F-1500, maximum horsepower 215 at 1200 rpm on natural gas.

Model L-3460, maximum horsepower 595 at 1350 rpm on natural gas.



BASIC ENGINE CHARACTERISTICS*

| GASOLINE OR NATURAL GAS | | | | | 600 | 800 | 1000 | 1200 | 1400 | 1600 | 1800 | 2000 | 2200 | 2400 |
|-------------------------|------------|-------|--------|------------|---|-----|------|------|----------------|------|------|------|------|------|
| MODEL | Bore & S. | Cyls. | Displ. | Torque-rpm | BRAKE HORSEPOWER AT ENGINE SPEEDS INDICATED | | | | | | | | | |
| H540 | 4½ x 4¼ | 8 | 540 | 430- 900 | ... | 64 | 82 | 99 | 115 | 130 | 143 | 155 | 164 | 170 |
| H844 | 5½ x 4½ | 8 | 844 | 637-1500 | ... | 106 | 135 | 165 | 191 | 215 | 237 | 255 | 270 | 278 |
| F1500 | 6¾ x 7 | 6 | 1503 | 1090- 650 | 125 | 165 | 200 | 215 | | | | | | |
| H2000 | 6¾ x 7 | 8 | 2004 | 1485- 650 | 170 | 225 | 270 | 290 | | | | | | |
| L3000 | 6¾ x 7 | 12 | 3006 | 2200- 650 | 250 | 335 | 405 | 435 | | | | | | |
| L3460 | 7¼ x 7 | 12 | 3468 | 2570- 900 | 285 | 391 | 492 | 568 | 595 @ 1350 RPM | | | | | |
| L4000 | 7.54 x 7.5 | 12 | 4000 | 2930- 900 | 325 | 446 | 560 | 645 | | | | | | |

*With oil pump, water pump, magneto, air cleaner, carburetor, and exhaust muffler. Hp shown is maximum.

SEE YOUR ROILINE ENGINE DISTRIBUTOR

ARIZONA, Casa Grande, Engine Service Company, Inc.
 ARKANSAS, Paragould, Wonder State Manufacturing Co.
 CALIFORNIA, Long Beach, Engine & Equipment Company
 COLORADO, Denver, Emrick & Hill Engine & Equip. Co.
 KANSAS, Garden City, Carson Machine & Supply Co.
 LOUISIANA, New Orleans, Southern Engine & Pump Co.
 MICHIGAN, Reed City, Hafer Engine Company
 NEW YORK, Syracuse 6, J. C. Georg Corporation
 OHIO, Columbus 19, Cantwell Machinery Company

OKLAHOMA, Oklahoma City 9, Carson Machine & Supply Co.
 PENNSYLVANIA, Bradford, R. R. Reck Company
 TEXAS, Houston 1, Southern Engine & Pump Co. (also in
 Beaumont, Corpus Christi, Dallas,
 Edinburg, Kilgore, San Antonio)
 Lubbock, Farmers Supply
 Odessa, General Machine & Supply, Inc.
 Wichita Falls, Nortex Engine & Equipment Co.
 WYOMING, Casper, Emrick & Hill Engine & Equip. Co.

424-R-1

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. / **New York • Tulsa • Los Angeles**
 Factories: Waukesha, Wisconsin and Clinton, Iowa

To order these helpful booklets check the reply card opposite page 34.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

Highway Lighting Engineering Guide

207. This catalog is primarily aimed at the new highway lighting program that is being undertaken nationally. It gives data on the quantity of light required; lighting on main traffic lanes, interchanges, intersections, toll plazas and bridges. It also covers information on the relative cost of lighting and the selecting of the light source. Write to Westinghouse Electric Corp., Lighting Div., 1216 West 58th St., P. O. Drawer 5817, Cleveland, Ohio.

New Reflectorized Sign Faces Refurbish Old Traffic Signs

292. Get complete details on new "EZ-On" traffic sign faces ready for immediate shipment. Reflectorized faces cost about one half as much as new signs and are easily attached to existing traffic signs. Grace Sign & Mfg. Co., St. Louis 18, Mo.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 7, Kans.

Case History of a Major Street Lighting Improvement

562. A joint project between the city and the utility on a street lighting improvement is moved in literature from Pfaff & Kendall, 84 Foundry St., Newark 5, N. J. Check the reply card for data on how this job was done.

Lighting Standards for Every Outdoor Lighting Requirement

284. Complete design details, typical installation photos and how Hy-Lite standards are made are covered in this valuable guide. Check the reply card or write to the American Concrete Corp., 5092 North Kimberly Ave., Chicago 30, Ill., for Catalog 400.

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Bare Pavement Maintenance With Sterling Rock Salt

84. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safe-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Co., Inc., Scranton, Pa.

Catalog on Tractor-Driven Tailgate Spreader

182. Highway Equipment spreader spreads in the echelon pattern for ice control and the blanket pattern for seal coating. For literature write Highway Equipment Co., Dept. H41 616D Ave. N. W., Cedar Rapids, Iowa.

Snow Plows For Every Need

294. Frink snow plows are designed to meet snow removal needs at airports, parking lots and streets and highways. They consist of four basic types with models to fit trucks 1½ to 12 tons. For complete data write Frink Snow Plows, Inc., Clayton, N. Y.

Formulation for use in Thermal Snow and Ice Removal Systems

493. The properties and advantages of Dowtherm SR-1, a heat transfer fluid, and typical installation layouts are covered in catalog available from The Dow Chemical Co., Midland, Mich.

Use The Reply Card

Rock Salt For Ice and Snow Removal

534. Application rates and procedures of using Morton rock salt for ice and snow control are covered in catalog from Morton Salt Co., 110 No. Wacker Drive, Chicago 6, Ill. Check the reply card for Catalog F-35.

Calcium Chloride For 2-Way Highway Ice Control

538. For data on the use of calcium chloride in ice control write Solvay Process Div., Allied Chemical & Dye Corp., 61 Broadway, New York 6, N. Y. Check the reply card for full details.

Lift or Lower Snow Plows Automatically

540. Battery operated or fan-belt driven hydraulic controls that lift or lower snow plows are described in literature from Mowarch Road Machinery Co., 1331 Michigan St., N.E., Grand Rapids 3, Mich. Check the reply card.



"LOOK!
YOU CAN'T
BEAT THIS
ANYWHERE!"



**LOWER
FIRST COST.....**
(by ONE-HALF!)

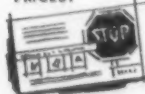
**LOWER
MAINTENANCE COST...**
(by ONE-HALF!)

'EZ-ON' Traffic Sign Faces are flanged to clamp right over present signs. Made in 24 and 30 in. sizes, octagon and diamond, in red and white, yellow and black. Fully reflectorized. They meet every need at HALF the price of ordinary signs!

with **"EZ-ON"**
TRAFFIC SIGN FACES

by **GRACE**

SEND FOR FREE
BOOKLET AND
PRICES!



GRACE SIGN & MFG. CO.
210 President Street • St. Louis 18, Mo.

Name _____

Address _____

Your Choice for Convenience in PITTSBURGH

**JACKTOWN
MOTOR HOTEL**

The very finest accommodations. 60 air-conditioned rooms with TV, telephone, combination tile baths. Excellent dining room. Facilities for group parties 15 to 500.

Route 30
1 mile West of Irwin Interchange
Underhill 3-2100

HOTEL PITTSBURGH

Right in the heart of the Golden Triangle 400 outside rooms with TV and every comfort of modern hotel design. General Forbes Lounge and Dining Room ... Air Conditioning. Airport Limousine and Taxi Service.

Forbes Avenue Below Grant
Atlantic 1-6970

**KNOTT
HOTELS**

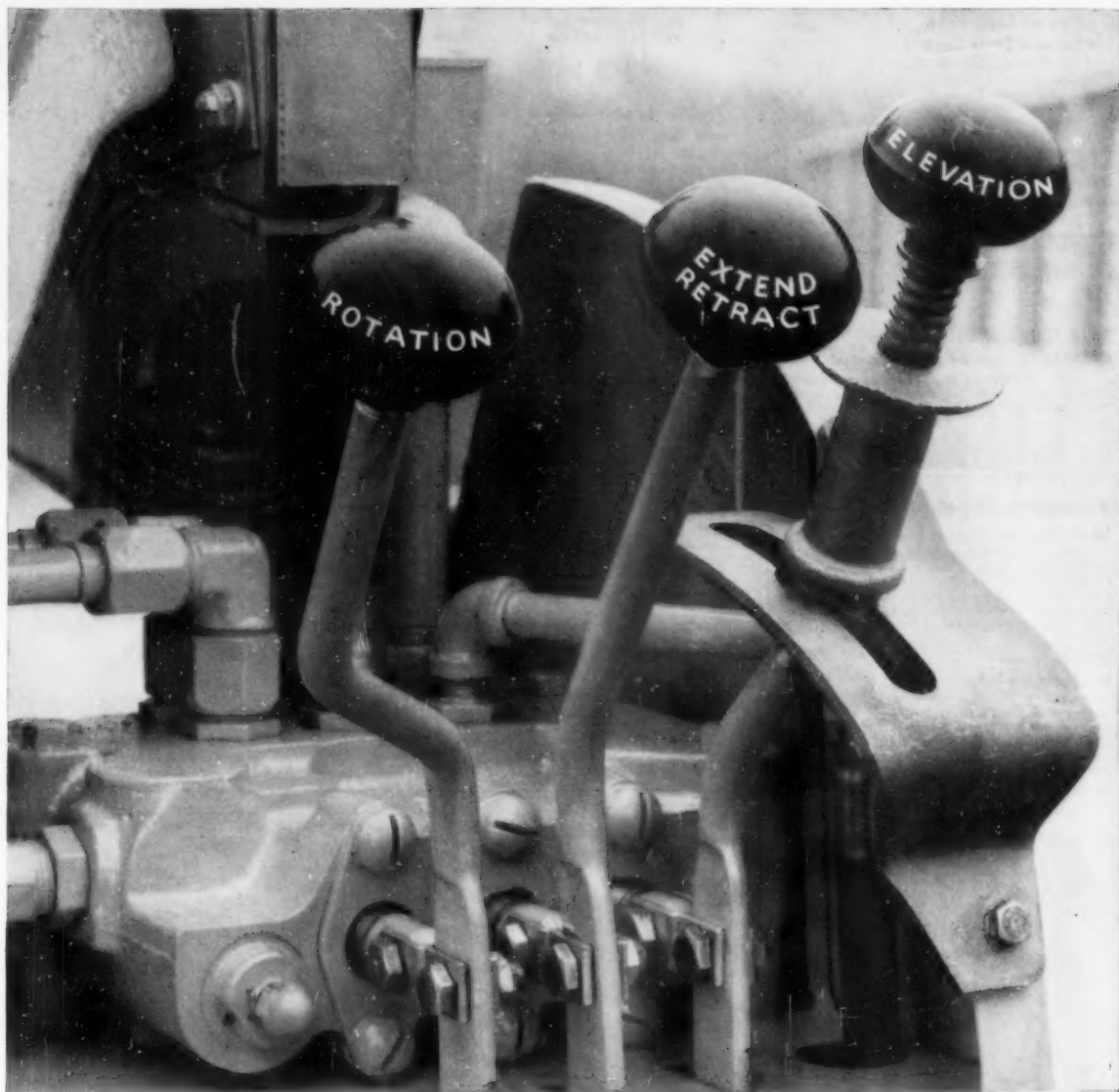
Joseph F. Duddy,
Gen. Mgr.

* Teletype Service. For immediate confirmation of reservations at no charge ... telephone any Knott Hotel—or teletype PG-29.

HOTEL PITTSBURGH MOTOR

Opposite Greater Pittsburgh Airport on beautiful Airport Parkway West. 56 luxurious, air-conditioned rooms with tile bath, TV, private phone. Courtesy car to and from airport.

AMherst 4-5152



Complete Ladder Control

Any ladder can have control levers. The big difference is in what you can do with them. Complete control *should* be in the hands of the operator at all times.

This Holan all-hydraulic ladder goes where you want it to go because of a smooth operating valve with throttling grooves in the spools. It stays in position because of built-in check valves that lock the load when the ladder stops moving.

You can turn 360° either way, elevate up to 75° and extend and retract the fly ladder. There's no physical exertion; you just move the levers.

Accurate control is not a luxury. It saves time and it's safe. Ask your Holan Field Representative about this Series 2100 Ladder and other ladders in the industry's most complete line of aerial equipment. Write for catalogs about Holan hydraulic, mechanical and pushbutton ladders.

Holan Corporation, 4100 W. 150th St., Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Ariz.

Holan [®]
Subsidiary of THE OHIO BRASS COMPANY **HOLAN**

To order these helpful booklets check the reply card opposite page 34.

Catalog on Equipment For Ice and Snow Control

213. Information on Baker snowplows and Flink ice control spreaders is available from The Flink Co., Dept. 3613, Streator, Illinois. Fully covered are reversible and one-way plows with hydraulic power lifts to meet every specification and single or dual spinner type spreaders. For reference catalog #110 check the reply card.

Winter Road Maintenance With Calcium Chloride

386. This bulletin contains data on why calcium chloride mixtures work better, how and in what percentages to store, mixing methods and recommendations for various storm conditions. Check the reply card or write Columbia Southern Chemical Corp., One Gateway Center, Pittsburgh 22, Pa., for your copy.

Sand, Chip and Calcium Chloride Spreader For Ice Control

429. Complete specifications, performance records and prices on the Fox sand spreader are covered in literature from Fox River Tractor Co., Dept. R3, P. O. Box 469, Appleton, Wis. Spreader can be attached or removed from most any dump truck in 15 minutes and can be operated from 5 to 40 miles per hour. Check the reply card.

Cut Snow Plowing Costs With Hydraulic Snow Plow Control

448. The Hydro-Clutch develops power to raise a snow plow blade completely in 6 secs. Check the reply card or write Gar Wood Industries, Inc., Wayne, Mich., for complete data on this Hydro-Clutch pump, cylinder and complete hydraulic system.

How to Make Ice Surfaces Safe

453. A bulletin on how calcium chloride works in ice control and directions for its use has been made available by Wyandotte Chemicals Corp., Michigan Alkali Division, Wyandotte, Michigan. Other uses of calcium chloride are fully outlined.

CONSTRUCTION EQUIPMENT AND MATERIALS

Tractor Loader Can Be Converted Into Eight Different Machines

38. Multiple-purpose tractor loader can be converted to a street sweeper, backhoe, fork lift, angle dozer, crane and rotary broom in a short time. Check the reply card or write Massey-Ferguson Industrial Div., 1009 South West St., Wichita 13N, Kans., for well illustrated catalog.

A-C Crawler Tractor With Turbocharged Diesel Engine

113. Specifications and standard equipment of the Allis-Chalmers HD-21 crawler tractor are covered in Catalog MS-1243 available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis. Check the reply card for full details.

Ford Tractors Equipped With Loader of 2500 lb. Lift

142. New Ford tractors give you multi-job versatility with a full line of attachments. Check the reply card or write Tractor and Implement Div., Ford Motor Co., Birmingham, Mich., for data on this rugged and powerful tractor.

Austin-Western Construction Equipment Catalog

240. Power graders, street sweepers, road rollers, crushing and screening plants and hydraulic cranes are covered in catalog from Austin-Western, Construction Equipment Div., Baldwin-Lima-Hamilton Corp., Aurora, Ill.

Barber-Greene Continuous Asphalt Plants

320. This catalog covers the Model 848-A asphalt plant and presents each typical plant setup and separately shows the details of each component. Check the reply card or write Barber-Greene, Aurora, Ill., for your copy.

Modern Economical Tractors and Tractor Units

231. Up-front operator position, Quadra-torque operation and greater ground clearance are some of the features of the new Elmco tractors. Check the reply card or write The Elmco Corp., Tractor Loader Div., 634 South 4th West, Salt Lake City, Utah, for your literature.

Booklet Shows Design of Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your buildings needs. In a helpful 16-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Write to Butler Mfg. Co., Kansas City, Mo.

Hydra-Drives Power Shift Transmissions

283. With four speeds forward and reverse, the Hydra-Drives is ideally suited for vehicles which must travel in both directions during a normal work cycle. Check the reply card or write Rockwell-Standard Corp., Transmission and Axle Div., Detroit 32, Mich., for full details.

The Principles of Compaction by Vibration

288. Compaction specifications that can't be met with ordinary compactors are no problem to the new Essick vibrating rollers. Complete descriptive literature explaining the principles of compaction by vibration and the Essick vibrating roller is available from Essick Mfg. Co., 1950 Sante Fe Ave., Los Angeles, Calif.

Allis-Chalmers Crawler Tractors and Motor Scrapers

306. Two catalogs offered by the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis., give engineering features and operating advantages of the TS-260 motor scraper and the HD-6 diesel powered crawler tractor. Check the reply card for specifications.



... ample power to rip through tough roots and earth formations
... full speed and torque right up to stalling point ... safer to operate than engine or electric drives.

FASTER
Pipe
Installation

LESS WASTED
TIME

WRITE FOR
BULLETIN

HYDRAUGER

HYDRAUGER CORP., LTD.

681 MARKET STREET
SAN FRANCISCO 5, CALIF.



BEWARE OF PIPE SHRINKAGE!

NPRC GUARANTEES COMPLETE RESTORATION
OF CLOGGED WATER AND SEWER MAINS

Custom-built POWER equipment teamed with professionally trained crews make NPRC's pipe cleaning unique. Through the vast experience of many jobs throughout the country, NPRC offers maximum results for ANY job, large or small ... with peak efficiency and speed plus lowest costs ... 100% money-back guarantee.

CONTACT ... THEN CONTRACT ... NPRC IS AMERICA'S LARGEST
WATER MAIN AND SEWER CLEANING CONTRACTORS

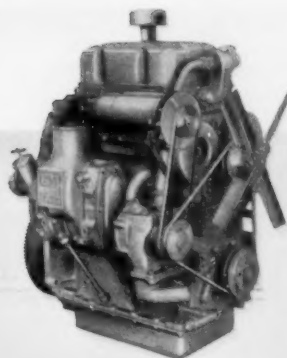
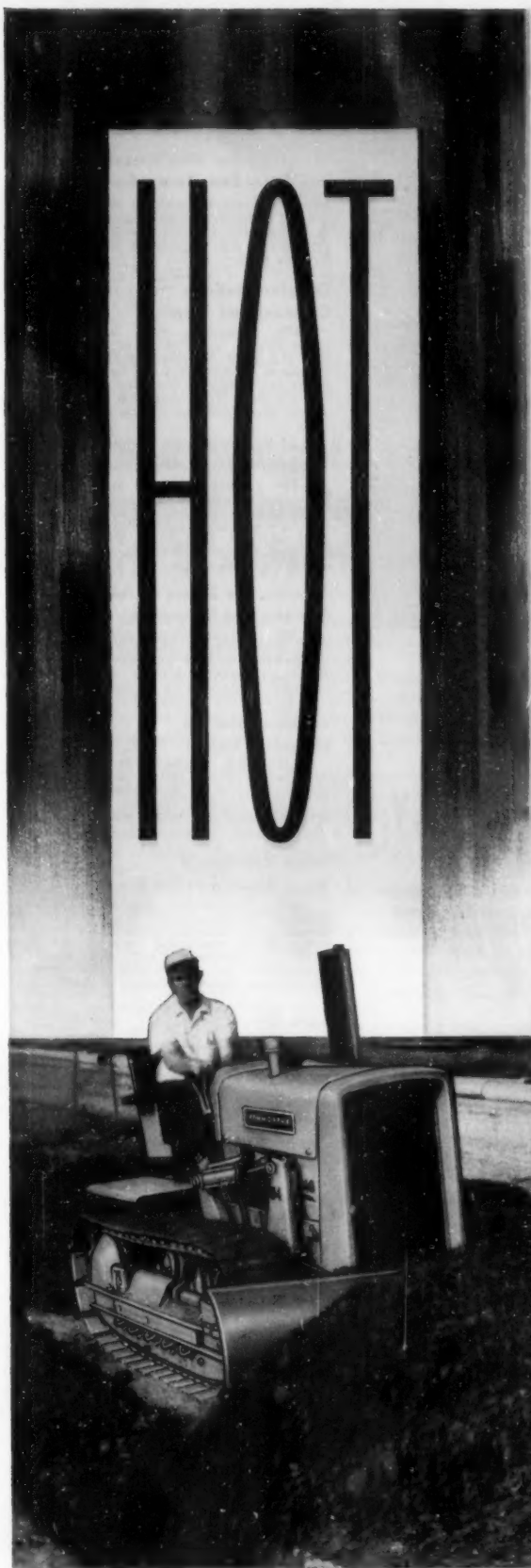
For FREE facts, surveys & estimates on your problem,
Call Collect, MOnroe 6-7700, Chicago, or write or wire.



NATIONAL POWER RODDING CORP.

General Offices:
1000 So. Western Ave. • Chicago 12, Ill.

WRITE FOR FREE CATALOG — THE STORY OF POWER



A demand item—in less than a year! In the short time since its introduction, the JOHN DEERE "440" CRAWLER with field-proved DIESEL ENGINE has established a new high standard of performance for industrial units in its class.

In building construction, logging, public works and other industrial fields, the new "440ICD" is now daily proving its right to the claim of . . .

"Low-Cost Power with a Heavyweight Punch"

JOHN DEERE

John Deere Industrial Division, Dept. 2087, Moline, Illinois





Austin-Western Model 60 Sweeper leaves street and gutter fresh and clean.

Austin-Western Model 60 sweeper replaces 6 men, 2 trucks in Batavia, N.Y.

"The Austin-Western sweeper is maneuverable . . . tricycle steering lets you get right in close to parked cars. Plenty of visibility, too. The operator sits right up front where he can see what he's doing and where he's going. You don't have such good visibility on sweepers with front end hoppers!" That's what Batavia, N.Y., maintenance chief, Art Snyder, has to say about sweepers.

Rear dump feature important

"On the average," Mr. Snyder reports, "we can sweep 18 miles before making a run to the dump. The 4-plus cu. yd. hopper really holds a load! The A-W has plenty of speed to travel to the dump and back quickly. The hydraulic controlled rear dump feature saves time too. Just dump and drive forward, all in about a minute.

"One man on the A-W 60 replaces 6 men and 2 trucks. Before, when we dumped on the street, the trucks and

men followed and hauled the loads to the dump. Now trucks and men can be kept at their regular job assignments and no extra help need be hired. These are real dollar savings that mean a lot to Batavia and to our department's budget!

Sold on Austin-Western

"We've been using Austin-Western sweepers here for over 20 years. We've also got a 1933 A-W 12-ton 3-wheel roller and a 1948 99H grader. Service from our A-W distributor is good. Maintenance on all our A-W equipment is low. Just routine service . . . never any downtime. We're sold on Austin-Western!"

Two Austin-Western sweepers available—Model 60, with 4-plus cu. yd. hopper capacity, and the 2-cu.-yd. Model 40. For complete information, see your nearby A-W distributor or write us today!

Austin Western

BALDWIN · LIMA · HAMILTON

Power graders • Motor sweepers • Road rollers • Hydraulic cranes



Electric Submersible Contractor Pumps

376. Capacity curves, specifications, accessories and list prices of Flygt electric submersible contractor pumps are covered in literature from Stanco Mfg. & Sales Inc., Construction Equipment, 1666 Ninth St., Santa Monica, Calif. Check the reply card.

Motor Graders With Torque Converter and Power Shift Transmission

430. Complete operation data and specifications of Huber-Warco motor graders are covered in Bulletin No. HWG521 available by checking the reply card or by writing Huber-Warco Co., Marion, Ohio.

Complete Bulletin

On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100 page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 155 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill.

Agent For Improving Adhesion

Between Old and New Concrete

530. Thorobond liquid bonding agent for improving adhesion of new concrete to old concrete walls, floors and ceilings is described in literature available from Standard Dry Wall Products, Inc., New Eagle, Pa. Check the reply card for information on typical uses and methods of application.

Specification Sheets on John Deere

Tractors and Equipment

588. Information and specifications on the John Deere crawler and wheel-type industrial tractors and working equipment. Deere & Co., Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

A Completely

Hydraulic Ladder

610. This completely hydraulic ladder is described in a new catalog published by J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Detailed drawing of the pedestals, throttle control and ladder construction are included.

What You Should

Know About a Motor Grader

673. Photographs, sketches and other instruction illustrations aid readers to visualize details of the Allis-Chalmers Model Forty-Five motor grader mechanical features and components. The catalog also tells about attachments and accessories. Write Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc.

Slide Rule P51

Calculator For Concrete

713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

RECREATION


How to Equip Your

Parks and Playgrounds

414. A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, park picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the reply card.

Rubberized Playground Surfacing Material

668. Saf-Pla can be applied to black top, concrete or properly surfaced areas to reduce injuries from children falling. Check the reply card or write to U. S. Rubber Reclaiming Co., Inc., Box 365, Buffalo 5, N. Y.



Here's how Wrought Iron Pipe cuts costs at Cleveland's Southerly Sewage Disposal Plant

Few services are as punishing, corrosion-wise, as those found in sewage disposal installations. Sludge digestion and elutriation tank pipe for example—they can be rough.

That's why Cleveland engineers specified more than 115 tons of wrought iron pipe in the city's Southerly Sewage Disposal Plant improvement program. They wanted no troublesome and expensive shutdowns due to pipe failures in inaccessible locations.

Wrought iron pipe was installed at the Southerly site in the following services: Sludge digestion and elutriation tank piping; cold water lines—1" to 2½" downspouts and leaders; all heating piping; handrailings; blower lube oil piping; perforated pipe diffusers; expansion tank piping; air piping; diesel oil piping; exhaust gas piping.

In years of service life per piping dollar, wrought iron's supremacy in severely corrosive sewage disposal services has been proven time and time again. Wrought iron's corrosion resistance stems from a structural feature duplicated in no other metal—glasslike iron silicate fibers (250,000 per cross sectional square inch)—entrained in the pure base metal. These fibers act as barriers to corrosive attack.

And to further augment these unique physical properties, Byers Research just recently developed new 4-D Wrought Iron. It is 25% more corrosion resistant than standard wrought iron and ferrous substitutes. It is available now in tubular and hot rolled forms for your new design and maintenance considerations. Write us for new 4-D Wrought Iron literature. A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

BYERS Wrought Iron Tubular and Hot Rolled Products

ALSO ELECTRIC FURNACE AMBALLOY STEEL PRODUCTS AND PVC PIPE

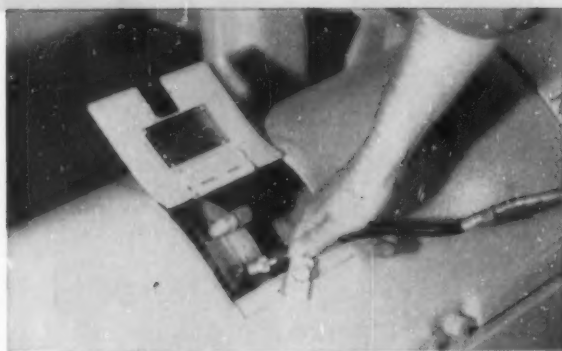
Corrosion costs you more than Wrought Iron

The entire improvement program is supervised by City of Cleveland's Director of Public Utilities, Emil J. Crown, and is under the direction of Commissioner of Engineering, G. W. Hamlin, and Commissioner of Division of Sewage Disposal, W. E. Gerdel. Havens and Emerson, Consulting Engineers, Cleveland, designed the Southerly project.

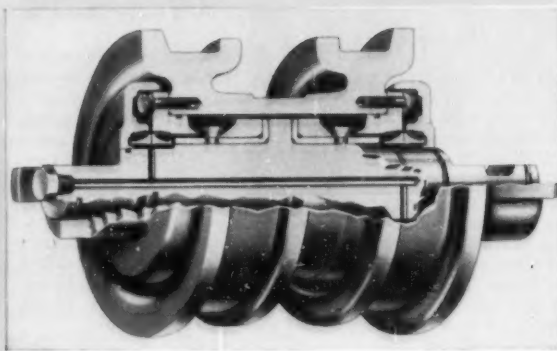


VERSATILITY SPEED

ADD UP TO TOP PRODUCTION

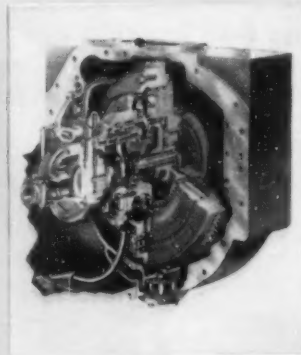
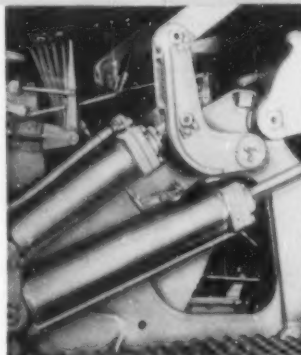


HYDRAULIC TRACK ADJUSTERS standard on the No. 977 and No. 955—optional on the No. 933. An ordinary grease gun is all that's needed to adjust tracks. Just open the inspection door and apply a few strokes. The hydraulic cylinder does the rest.



LIFETIME LUBRICATED ROLLERS. They need no lubrication servicing until rebuilding. Heat-dissipating oil lubricant is retained by dirtproof floating-ring seal. Eliminate on-the-job roller lubrication. Keep machines on-the-go for longer periods of time.

SMOOTH-FLOW BUCKET CONTROL LEVER. The inside lever is pulled back, lifting the load. It locks in this position until it is kicked out at maximum height by the lift cylinder and linkage. After dumping, both levers are pushed forward. The bucket lowers but only tilts back to an adjustable, preset digging position. Linkage then kicks the outside lever, stopping the bucket tilt.



EXCLUSIVE CATERPILLAR OIL CLUTCH...the most advanced clutch design ever offered. Provides up to 2,000 hours without adjustment. This is equal to about 12 months of "adjustment-free" operation. And because wear rate of clutch facing is so slight, down time for clutch repair is almost eliminated.



DEPENDABILITY

IN A TRAXCAVATOR

WHATEVER THE JOB... whatever the conditions... there's a Caterpillar-built Traxcavator to take charge. Advance design has given this machine a reputation for speed... efficiency... low operating and maintenance costs. For this is a digging and loading tool; not a tractor attachment.

The line is complete. You get top production from three Traxcavators... the No. 933—52 HP, $1\frac{1}{8}$ cu. yd. bucket; the No. 955—70 HP, $1\frac{1}{2}$ cu. yd. bucket; the No. 977—100 HP, $2\frac{1}{4}$ cu. yd. bucket. And there's a complete range of quick-change attachments... special buckets, bulldozers, forks, the exclusive side dump bucket and the rear-mounted ripper.

Traxcavators are built to last. They have a heavy steel main frame, welded into a one-piece unit. Box construction track roller frame absorbs the loads and stresses of tough treatment. Lift arms are made to stand up under the strain of heaviest digging conditions.

Traxcavators give you fast action and ease of operation. Excellent stability and balance give better control of the machine. A fast hydraulic system cuts cycle

time and increases maneuverability even in close quarters. Visibility is excellent. The high seat puts the operator on "top" of the work. Operator's compartment is uncluttered. Tractor controls are conveniently located for handling ease. Bucket controls are at the right armrest... closely spaced for dual operation with one hand.

The reliable Caterpillar Diesel Engine has a fuel-saving injection system and ability for hard lugging. Each engine is matched to the machine for power and bucket size.

All of these features pay off in top production. Let your Caterpillar Dealer help you choose the Traxcavator best suited for your job. Get production facts and figures. And ask for a demonstration.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

**BOOST PRODUCTION
AND LOWER COSTS WITH
A VERSATILE TRAXCAVATOR**

BRUSH DISPOSAL CREWS OPERATE FULL TIME WITH THE TROUBLE-FREE

FITCHBURG CHIPPER



CITY

This low-maintenance Fitchburg Chipper is disposing of brush in the City of Holland, Michigan.

PUBLIC WORKS DEPT.

"Our Fitchburg Chipper consolidates the bulk, thereby lessening dumping operations. It requires minimum maintenance and manpower."

Dept. of Public Works
State of Rhode Island

TREE COMPANY

"We have never had one (Fitchburg Chipper) wear out or give excessive trouble." Chipper still operating after 9 years.

Dovey Tree Surgery
Co. Ltd.
San Francisco, Calif.

UTILITY

"Our men have been particularly pleased with their Fitchburg Chippers . . . they are rugged and reliable."

Rockland Light
& Power Company
Nyack, New York

When crews go out to trim trees, it's costly to have machine breakdown. That's why foresters, park superintendents, line clearing supervisors, and tree companies prefer the Fitchburg Chipper. This well-engineered brush chipper is designed for busy, trouble-free service, no down-time.

The rugged Fitchburg Chipper requires little upkeep, and has low maintenance cost. It's economical to operate. And crews like the exclusive spring-activated feed plate which adjusts itself automatically to any size brush up to its rated capacity. This patented feed-plate provides protection from damage from foreign materials, makes for greater crew safety.

The Fitchburg Chipper is engineered to work fast, safely, and to be always "ready to go." It's the chipper which won't slow down your crews, lets you plan their work intelligently—saves you time and money.

Please send in the coupon for more information, and for copies of articles on chipping which appeared recently in leading publications. These feature articles describe five methods of brush disposal and ten new ways to utilize "by-product" chips. Send for your copies, they are well worthwhile.

**FITCHBURG
ENGINEERING
CORPORATION**
FITCHBURG, MASS.

FITCHBURG ENGINEERING CORPORATION
Dept. PW-119, Fitchburg, Massachusetts

☐ Please send me important articles which describe 5 methods of brush disposal, and 10 new ways to utilize brush chips.

☐ Please send more information on Fitchburg Chippers.

Name _____

Address _____

City _____ Zone _____ State _____

LETTERS

TO
THE EDITOR

TELEVISION CABLE SERVICE

We read PUBLIC WORKS Magazine with great interest, and we appreciate the many efforts you have gone to to bring worthwhile information to small communities. We read with interest your articles on municipal affairs.

We are now in the process of trying to determine fair rates for providing television cable service in our community. We, unfortunately, are in an area which is blacked out from natural reception. The rates in force here are \$135 for the installation of the cable, and \$5 per month. We feel that this is high, inasmuch as every community within a hundred mile radius is charging a lower rate.

The reason we are writing to you is to find out whether your staff has at any time considered this question, and written any articles with respect to this matter. If so, we would appreciate having copies of the same.

We would appreciate hearing from you at your earliest convenience.

J. V. Coan
Member Board of Trustees
Grants, New Mexico

Ed Note: Will those of our readers who have information pertinent to Mr. Coan's needs communicate directly with him?

• • •

Sewerage and Water Installations in Pennsylvania in 1958

The Department of Health of Pennsylvania reports that 69 waste treatment plants were completed in that state in 1958. Of these, 45 were for sewage and 24 for industrial wastes. The sewerage contracts awarded during the year amounted to about \$40,000,000. Also 39 new water supply or treatment installations were placed in operation and construction was initiated on 32 others.



For the best in outdoor flooring

Specify BLAW-KNOX Electroforged Steel Grating and Treads

For safe, all-weather, outdoor flooring, made to take punishment and stand the strain, specify Blaw-Knox Electroforged Steel Grating and Treads. Proven on outdoor installations in all parts of the world, Blaw-Knox grating has an established reputation for quality, durability, and safety.

Easy installation—rigid one-piece construction fits readily around pipes, beams, and equipment.

Maximum load bearing capacity—Electroforging eliminates slotting or otherwise weakening bearing bars . . . one-piece construction increases structural strength.

Safest walking surface—non-slip, twisted crossbar plus choice of two types of bearing bars. Square, for smoothest walking surface . . . serrated, for maximum safety under extremely hazardous conditions.

Self-cleaning—Electroforged construction leaves no sharp angles to clog with dirt or grease. Being open, rain water usually provides all the cleaning necessary. Maximum open area allows light for working beneath floor.

Blaw-Knox has the grating and treads best suited to your needs. For information on how to specify and order, send for your copy of Blaw-Knox Bulletin 2527-R.

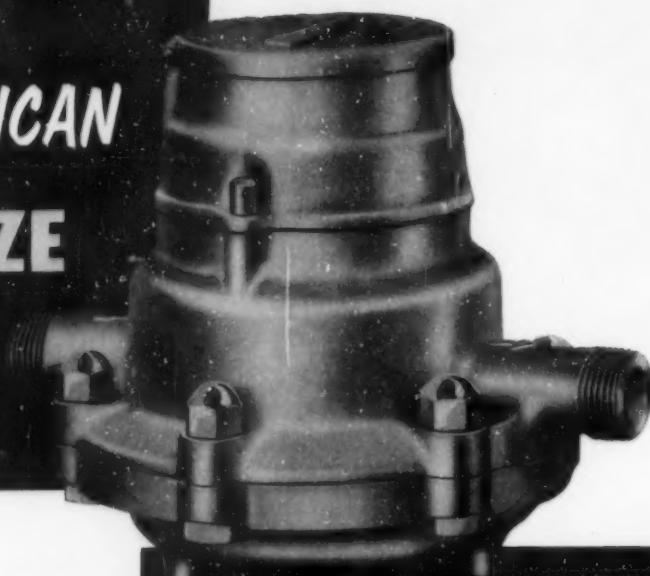


BLAW-KNOX COMPANY

*Blaw-Knox Equipment Division
Dept. W, Pittsburgh 38, Pennsylvania*

Another *FIRST!* The New *AMERICAN* **ALL BRONZE**

FROST BOTTOM METER



Actual photograph of Bronze Frost Bottom after freezing.



- Snaps cleanly at the same breaking pressure as a cast iron bottom.
- Internal Metal Parts — Meter Body — Frost Bottom — all made of Bronze. No dissimilar metals exposed to water.
- Complete Frost Protection to all working parts in both water lubricated and oil-enclosed gear train models.

Bottom does not drop out when broken. It is kept from falling by the flange bolt heads.

Now for the first time, a true frost-bottom water meter of all bronze construction. This new AMERICAN Water Meter maintains all of the superior features and dependable qualities of the cast iron bottom type, proven in more than 37 years of service.

Should the meter freeze, the center section breaks out at 500-550 psi, to relieve strain on all internal parts. Type and place of fracture are controlled by design. It breaks by tension, not by shearing of projecting lugs. Bottom casting is machined to establish predetermined breaking pressure that is independent of the tightness of the flange

bolts. Thus, every AMERICAN Frost Bottom Meter breaks in the *same* manner, at the *same* pressure, at the *same* place!

When the frost bottom breaks, all interior parts, including the gears, separate and move with the ice to avoid damage. After a freeze-up, only the bottom has to be replaced — a low cost, easy operation.

If you have meter freezing problems, investigate the new cost-saving ALL-BRONZE, AMERICAN Frost Bottom Meter. Write for literature.

BUFFALO METER COMPANY
INCORPORATED

2920 Main Street
Buffalo, New York



Protect against accidents like this!

Use straight Morton Rock Salt—the most effective way to help
keep streets, freeways and tollroads safer in winter

Straight Morton Rock Salt does the job abrasives and Salt mixed with abrasives can't do to help prevent accidents caused by ice and snow. Morton Rock Salt gives *abrasive traction* against skidding even before the salt starts to melt the ice. Rock Salt crystals are larger than other commonly used ice melting chemicals and *penetrate ice deeper* with a corkscrew action—not just melt surface ice. Due to Rock Salt's better penetration, it reaches the pavement fast and quickly *melts* the bond between ice and the street surface.

Morton Rock Salt is safe, clean, economical

Straight Morton Rock Salt is non-toxic. It does not damage animals' paws, rubber, fabrics, leather, asphalt, brick or properly seasoned concrete. It will not clog sewers or leave a rutted, dirty pavement as will sand or cinders. What's more, Rock Salt melts *more ice at lower cost* at any temperature above 8° F. than any other commonly used ice melting chemical.

PUBLIC WORKS for November, 1959

Send for more information today!

- ☐ Please send me your free book on ice and snow removal.
☐ I would like a Morton representative to advise me on how best to stockpile Morton Rock Salt.

Name

Title

Address

City Zone State

MORTONSALT COMPANY

INDUSTRIAL DIVISION

Dept. PW-11, 110 No. Wacker Drive, Chicago 6, Illinois



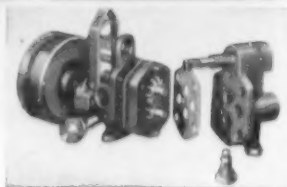
LEADING SNOW PLOW MANUFACTURERS OFFER



| | |
|--------------------------------|-----------------------------|
| Anderson Engineering Co., Inc. | Frink Sno-Plows, Inc. |
| Balderson, Inc. | The Gledhill Road Machinery |
| Balko, Inc. | Good Roads Machinery Corp. |
| Otto Biefeld Corporation | Ray Harman and Sons, Inc. |
| Braun's Welding Service, Inc. | Henke Manufacturing Corp. |
| Bros, Inc. | The Jarp Corporation |
| The Burch Corporation | Scranton Truck Body and |
| Dominion Road Machinery | Equipment Company |
| Co., Ltd. | Scheneker Iron Works, Inc. |
| Duplex Manufacturing Company | Wausau Iron Works |
| Flink Company | |



**with the ALL-NEW
FASTER ACTION
HYDRA-CLUTCH®
PUMP**

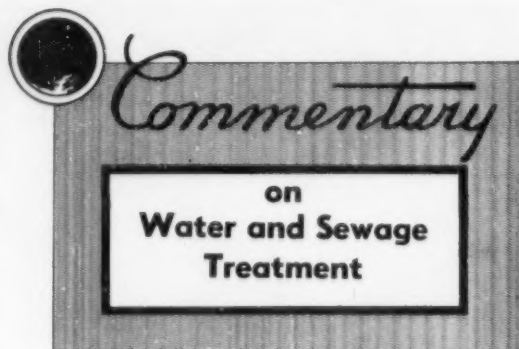


Exclusively from Gar Wood, the Snowlift Kit features the only clutch-type pump available for snow plow control. With the powerful Hydra-Clutch Pump, the pump gears are set in motion only when lifting the plow blade... a mere six seconds. This means far less wear and longer life for the pump... no battery drain. The Snowlift Kit includes Hydra-Clutch Pump, cylinder and complete hydraulic system.

Get the "cost cutting" details on the new Snowlift from your GarWood distributor or snow plow dealer

GarWood
INDUSTRIES, INC.

Wayne, Michigan • Richmond, California



MEASURING DIGESTER PERFORMANCE

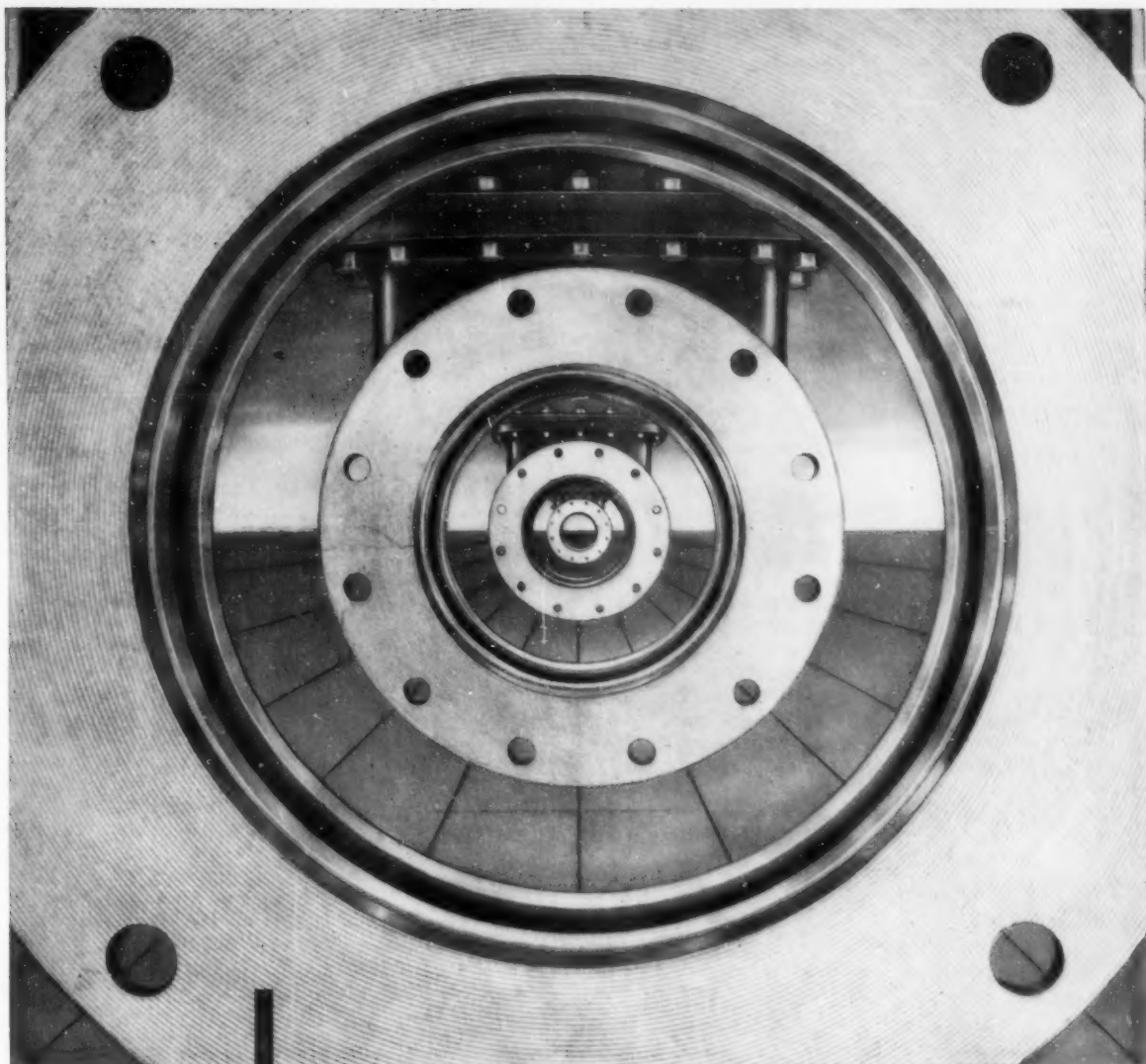
R. S. RANKIN

Consultant, Water and Sewage Treatment

OPERATION of sewage sludge digesters should include a frequent balancing of products introduced and the products removed from them. This is the logical method of evaluating true digester performance and it provides data for the accurate comparison of one installation with another. The efficiency of the sedimentation and biologic units are carefully determined in most plants and there is no reason why the efficiency of the digestion system should not be also determined. However, most operators seldom make such routine analysis, possibly because of lack of any requirement on the part of the regulatory agencies; or indifference, lack of time, or possibly because of not understanding the principles and procedure involved. A discussion of one method of evaluating digester performance may encourage more operators to make this a routine job.

The last 5 or 6 years has witnessed many discussions of high rate digestion indicating that something new has been discovered in the field of anaerobic digestion. Claims of greatly increased loadings are put forth as though some new force or process as yet undefined were at work. Undoubtedly some of these claims can be justified for reasons which seem obvious, because coincident with the increase in unit loadings, facilities for mixing the digester contents with much greater intensity than ever before have been installed which inevitably increases the efficiency of utilization of the tank volume. Currently this efficiency is estimated at twice that found in older unmixed tanks. Doubling the efficiency of utilization of the volume of any digester will in itself permit doubling the rate of feed with the same end result as in the unmixed tank.

For example, a 9000 cu. ft. unmixed tank might have two-thirds or 6000 cu. ft. of its capacity occupied by inert material such as grit, scum, trash or digested sludge which is not displaced in routine operation but remains in the tank indefinitely. In such a situation only one-third or 3000 cu. ft. of capacity is in active use and available for digestion. Mau (1) in his observations of Kansas plants showed this to be a likely condition in digesters and others have also expressed similar views. If sufficient mixing is then applied to cause one-half the volume of the



Through these Gate Valves pass
the best-regulated streams
in the World!

The sound design and quality workmanship of Ludlow gate valves and Rensselaer gate valves is a guarantee of *lasting* ease of operation. Watertight closure is assured through years of trouble-free performance.

Write for the L&R Gate Valve Catalogs,

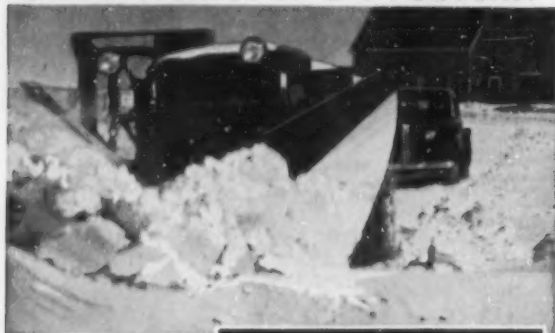
showing the most complete selection of outstanding design features available today. Ludlow and Rensselaer double disc gate valves meet all requirements, including A.W.W.A. specifications, in sizes from 2" to 72", plus custom designing for special applications.

LUDLOW & RENSSELAER

VALVES AND HYDRANTS

THE LUDLOW VALVE MANUFACTURING CO., INC., TROY, N. Y. - SINCE 1861

Snow Removal a Problem?



Think of **FRINK** Specialists Since 1921 in **SNOW PLOW** **KNOW-HOW**

Since the first steel plow (a Frink) hit the highway, every major advance in snow plow design and performance has been a product of Frink "know-how." Today there are four basic types of Frink Sno-Plows, each with models to fit trucks from 1½ to 12 tons, and most are interchangeable on the same attachment.

Whatever your area's snow removal problem, Frink makes THE plow best equipped to do the job faster, safer and at lower operational cost for plow and truck.

Learn all the facts and reasons why so many cities, towns, counties and states specify Frink Sno-Plows. See your distributor or write to Frink for descriptive folders about these plows.



V-TYPE SNO-FLOW
—rugged powerhouse for high-speed, heavy-duty highway work; leveling wings optional.



ROLL-OVER with Taper Blade
—for airports, expressways; rotates left or right in seconds; ends "dead-heading."



ONE-WAY with Trip Blade
—for high-speed throwing and spreading, but wind-rows neatly at city speed.



REVERSIBLE Trip Blade
—all-purpose; plows left, right, bulldozes ahead; power reverse lever in cab.

For Snow Plow Know-How
It Pays to Think of

FRINK
SNO-PLOWS

FRINK SNO-PLOWS, INC., CLAYTON, N. Y.
Eastern Steel Products, Ltd., Preston, Ontario-Canada

inert material to be thrown into suspension and displaced by normal sludge additions, then 6000 cu. ft. of capacity or twice that volume originally utilized will be available. As a consequence twice the former sludge load can be put through the same tank and yet produce the same end result as with half the load. The detention time or total tank volume divided by feed will be cut in half and by looking only at the tank performance, one might easily conclude a great step forward in anaerobic digestion has been accomplished.

In most laboratory and pilot plant digesters, displacement efficiencies probably approach 100 percent of utilization of the volume of the unit. With skillful operation the performance records would indicate a speed-up of up to three times that of the full-scale unmixed installation with only 33% displacement efficiency.

Does this mean there is nothing to high rate digestion except improved tank efficiency? Not at all; but so far this element of increased volumetric efficiency has not been given the credit it deserves as one of the contributing factors in the apparent speed-up of digestion. Until this is done no real yardstick for high rate digestion can be established.

How does one go about determining the volumetric efficiency of a digestion tank? There are several possible ways of doing it and most are tedious. They include making soundings, analyzing depth samples and even the impractical one of emptying the tank and measuring the volume of the inactive zone. Depth samples should indicate whether the contents are homogeneous but unless sampling points are well distributed, horizontally as well as vertically, the conclusions may be in error, particularly in tanks with a high ratio of diameter to depth. A more simple method is the balancing of raw products fed to the digester compared with the digested products removed, which can supply valuable information on this factor of volumetric efficiency.

A balance of products in and out of a digester should not be attempted until the digester is in a uniform daily operating routine. The temperature should be uniform, the feeding routine well established and at least three displacements of tank contents since starting or major change in routine should be completed. One displacement is assumed when the volume of feed is equal to the volume of the digester. The longer the interval covered by the accounting the more reliable it will be. A period of a year will usually overcome any abnormal seasonal variations, but a six-month period can provide much useful data.

The raw products fed into the digester include water and solids and the latter are divided into volatile and fixed or ash. The products removed include water in the supernatant and in the digested sludge; solids, both volatile and fixed, in the digested sludge plus those in the supernatant; and, of course, the gas which represents a definite quantity of solids. Balancing the water constituent in and out is of little practical significance and usually unnecessary. There remains the weight of dry solids and the volume of the gas to be carefully measured. Determining the weight of the raw solids entering the digester is probably the source of greatest error in these calculations, but by continued effort aimed at balancing the "in" with the "out" products, the source of these errors may be discovered and minimized.

On the subject of raw sludge analysis, in a recent article the author expressed the possibility of using

HERSEY

WATER METERS

MODELS HF — F
for
COLD CLIMATES

MODEL HD
for
WARM CLIMATES



1. Try them.
2. See for yourself.
3. Accurate registration —
Economical maintenance.

Even if they cost a few cents more,
the difference will easily be made
up in the increased revenue received.

HERSEY MANUFACTURING COMPANY

(Established 1859)

DEDHAM, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA
ATLANTA — DALLAS — CHICAGO — SAN FRANCISCO — LOS ANGELES

YOU CAN'T BUY A BETTER WATER METER THAN HERSEY



You name the place

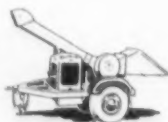
... and *without obligation to you*, a qualified representative will arrange a prompt demonstration of the fastest, most economical chipper in the world.

Then you can see for yourself how aggressive is the new power unit of ASPLUNDH CHIPPERS; how it hungrily for great loads of bulky brush; how easily it consumes limbs of 6" diameter.

And remember, the efficiency and economy of the completely safe, simply designed ASPLUNDH CHIPPER has been *proven in service* by the largest tree company in the world.

You will see, in demonstration, that an ASPLUNDH CHIPPER is, by far, the best buy in chippers on the market today.

WRITE TODAY for FREE illustrated folder and for a demonstration.



ASPLUNDH CHIPPER COMPANY

505 York Road, Jenkintown, Pa.

By Actual Test the Fastest Chipper Made

isotopes in some device for determining the solids content in sludge flowing through a pipe. It is a pleasure to learn that this device has actually been developed during the past year and two companies are now offering it for this specific application. It is hoped that it will receive due publicity and become a unit which can be justified in many plants.

In balancing the operations of any digester, certain assumptions are necessary. The first one is that the weight of fixed matter or ash contained in the raw sludge passes through the digestion process unchanged. Thus, for every 100 lb. of ash per day, month or year fed into the digester in the raw sludge, 100 lb. should be removed per day, month, or year in digested sludge. Any change in the constituents of the solids during anaerobic digestion is assumed to be in the volatile constituent. The second assumption is that the weight of the gas resulting from digestion equals substantially the weight of the volatile matter digested. This disregards for practical reasons the scientific debates of some years ago as to whether the weight of gas should be slightly more than the weight of volatile solids destroyed. Therefore, using a volume of 14.5 or 15.0 cu. ft. of gas as equal to one pound, the weight of the volatile solids digested can be computed.

Measurements most accurate and reliable in this accounting operation include the volume of gas produced in any given time interval and the analysis of the digested sludge solids, both fixed and volatile. The volume of the digested sludge can be determined from digester liquid levels, sludge bed measurements or from vacuum filter operations. With this information the weight of solids including total volatile and fixed in the digested sludge can be computed. Where sludge is drawn intermittently it is obvious why long time records are necessary.

If the performance of the first stage of a digestion system that also includes secondary or storage units is desired, the sludge should be sampled as it is being transferred from the first stage. This is important if the true performance of the first stage is sought, otherwise assumptions may be in doubt. The volume transferred is equal to the volume of raw sludge fed to the first stage less a minor correction for the liquid represented by the gas given off in this stage.

Having obtained the values as described, and assuming the weight of ash removed from the digester as equal to the weight of ash introduced in the raw sludge, then the weight of the volatile solids in the digested sludge plus that in the supernatant plus the equivalent weight of the gas should equal the weight of volatile solids in the raw sludge fed to the system. Where all material is transferred to a secondary or storage tank, the supernatant, of course, is absent. Again, it must be emphasized that this balance should be attempted only after routine operations of several months duration have been established. The actual time interval used in computing the weights may be a day, a week or a month.

This procedure may appear an attempt at unwarranted refinement. It is the only way that any operator can determine quantitatively whether his performance records are correct. Once this balance has been established and an operator is confident of its accuracy, he can then make comparisons with conventional digestion practice (2) and determine for himself whether his plant can be classed as having high rate digestion or improved volumetric efficiency, or both. Several plants have achieved this degree of refinement in their operations proving its feasibility.

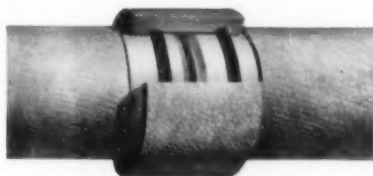


ASBESTOS-CEMENT PRESSURE PIPE

ITS BORE STAYS CLEAN YEAR AFTER YEAR FOR UNINTERRUPTED, TROUBLE-FREE SERVICE

"K&M" Asbestos-Cement Pressure Pipe is as modern as the Jet Age in which we live.

The bore remains smooth and clean always. Pumping costs remain low. Made of tough, high-tensile-strength asbestos fibers and portland cement, it's practically indestructible. Won't corrode or tuberculate. And, it's completely immune to electrolysis. Joints are permanently, automatically root-tight and water-tight.



The finest coupling in the industry! Exclusive patented "K&M" FLUID-TITE Coupling connects in two easy steps. Seals tight and stays tight . . . no matter how high the pressure climbs. Self-energizing sealing rings.

"K&M" Asbestos-Cement Pressure Pipe is a thrifty pipe. Its lightweight reduces shipping and handling costs. You can install it in practically all kinds of weather and soil conditions . . . with unskilled labor . . . and without heavy machinery. And, lay more pipe per hour than ever before.

What makes "K&M" Asbestos-Cement Pressure Pipe so special? Eighty-five years of asbestos engineering by one of America's pioneers in asbestos products. For more information, write to us today.

KEASBEY & MATTISON

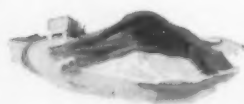
COMPANY • AMBLER • PENNSYLVANIA





Keep pavements bare all winter with Solvay Calcium Chloride

—SALT MIXTURES



This winter use the method of leading turnpikes that achieve "no shut-down" records despite the severest weather.

Combine Solvay® Calcium Chloride with salt. Make sure you have ample stocks on hand, at money-saving bulk rates.* It can be stored alone, or mixed with salt, outdoors under tarpaulin covers, in indoor sheds or covered bins.

Bulk handling of Solvay Calcium Chloride is a one-man operation, both in loading and application. It can be used economically by large and small highway departments.

Calcium chloride-salt mixtures are effective at all temperatures and humidities. While salt's best range is 25-32°F., calcium chloride speeds melting at all temperatures, even down to below zero . . . provides the moisture salt needs to act. Calcium chloride liberates heat as it melts ice, which helps salt work faster. When you combine the two, applications can be lighter and less frequent. This reduces chemical consumption and lowers cost.

For instant skidproofing of icy surfaces, treat abrasives with Solvay Calcium Chloride. They hold fast in wind and traffic at all temperatures.

*Also available in moistureproof bags.

.....
• Write us now. Request "ice control data." If
• you are interested in applying bulk handling to
• your set-up, ask for a Solvay representative to
• call. No obligation!
•
•



SOLVAY PROCESS DIVISION

61 Broadway, New York 6, N. Y.

SOLVAY branch offices and dealers are located in major centers from coast to coast.

It will add appreciably to the knowledge of digestion if this feature can be made a part of the operating report.

References:

- 1) Gordon E. Mau. Applying recent research to the design of separate sludge digesters. *Jrnl. Sew. & Ind. Wastes Assn.* Vol 28, 1956, Pg. 1199
- 2) Manual of Practice of Sewage Treatment Plant Design, ASCE, FSIWA, 1959 Pg. 206

• • •

Pollution Load on New York Harbor

It is estimated by the Division of Sewage Disposal of the New York City Department of Public Works that the residential population tributary to the Inner Harbor in New York and New Jersey is about 10,300,000, including some 1,200,000 population equivalent of industrial waste load. The total sewage flow entering the Inner Harbor is about 1,900 mgd. From data for New York City plants, it has been computed that each person discharges about 0.14 pound of BOD per day. On this basis, the raw sewage daily BOD load on the Harbor is estimated at 1,440,000 pounds. Of this 990,000 pounds originates in New York City, 390,000 pounds in New Jersey and 50,000 pounds in Westchester County.

The New York City treatment plants remove about 42 percent of the 990,000 pounds of BOD, or about 417,000 pounds per day. Available data indicate that 19 percent of the BOD from New Jersey and 6 percent of that from Westchester Co. is removed by treatment.

The Director of the Division of Sewage Disposal is William A. O'Leary and the Commissioner of Public Works of New York City is Frederick H. Zurmuhlen.

Mobile Bituminous Laboratory

A specially-equipped truck, outfitted by the Michigan State Highway Department's Office of Testing and Research, now moves the bituminous laboratory to the field. This mobile laboratory, consisting of an ordinary truck equipped with testing apparatus will bring testing facilities to the construction site, enabling engineers to obtain immediate test data on bituminous surfacing, according to W. W. McLaughlin, testing and research engineer. Information obtained from the tests will be used in making adjustments in bituminous design, construction procedures and general control of the quality of bituminous construction.

Basic equipment in the motorized laboratory, besides the testing equipment, includes a portable diamond coring machine for removing samples from the roadway, a hoist to manipulate the coring unit, water storage tank, gas stove and oven, and a gasoline-driven generator for powering various pieces of equipment. With its own power and utilities the laboratory is self-sufficient.

Water Statistics from Honolulu

The estimated population of Honolulu on July 1, 1958, was 307,000 (compared to 292,000 in the previous year). Of the 15,298 million gallons, 87.4 percent or 13,377 mg. passed through meters. The average per day supplied was 142 gpcd. The cost of supplying water per million gallons, computed on total maintenance, was \$170.92; and including fixed charges \$213.92 per million gallons.



Today's smallest two-way mobile radio - actual size!

New General Electric Transistorized Progress Line

General Electric's new Transistorized Progress Line will fit in more places, in more different positions, than any other two-way mobile radio you can buy today.

Not only is this the world's smallest, lightest commercial two-way mobile radio, but standby battery drain is so low you need never turn off your TPL mobile unit, just like the clock in your car. You install no special generator, use less gas, require fewer engine jobs.

TPL is the first two-way radio that transmits up to 75 watts of power in high band... the first that really fits under the dash... the first to realize the full benefits of transistorized design (no more than four tubes)... the first to eliminate bulky cables through new one-piece design of receiver control and transmitter... the first with shielded dirt-free ventilation.

The new General Electric TPL ushers in a new era of convenience and reliability in mobile communications. Don't miss all the exciting details. Write General Electric Company, Communication Products Department, Section 37119, Mountain View Road, Lynchburg, Virginia.



GENERAL  ELECTRIC

Communication Products Department

Reinforced Concrete Pipe Chosen For



This 96" diameter reinforced concrete pipe easily met the rigid requirements of ASTM Specification C76-57T. Tests indicated this reinforced concrete pipe was capable of loads exceeding 100,000 pounds, demonstrating the strength and durability.

S. J. Groves and Sons Company, Minneapolis, Minnesota—
General Contractor
Abbott Contractors, Chicago, Illinois—Sub-Contractors
Waukesha Cement Tile Company, Milwaukee, Wisconsin—Pipe Suppliers
American Vitrifed Products Company, Milwaukee, Wisconsin—
Pipe Suppliers
Lock-Joint Pipe Company, South Beloit, Illinois—Pipe Suppliers

Richard I. Bong Air Force Base Runway Drainage

More than 48,000 linear feet of concrete pipe was included in the Corps of Engineers specifications for the Richard I. Bong Air Force Base at Kansasville, Wisconsin. Many sizes were required, the largest being 96" inside diameter. All reinforced concrete pipe was manufactured and pre-tested to meet the rigid requirements of ASTM Specification C76-57T. The 96" pipe was required to meet a loading test of 96,000 pounds. It met this requirement easily and could have withstood loads exceeding 100,000 pounds!

Reinforced concrete pipe is designed in conformance with specifications comprehending the laws of mechanics plus the results of thousands of tests; it is manufactured by men experienced with concrete product production; and it is pre-tested to demonstrate its strength. The pre-testing is done by means of the 3-edge bearing test which is the most severe loading to which the pipe will ever be subjected!

Reinforced concrete pipe installations, in service for many years, are testimony to the strength, durability and watertightness of concrete pipe reinforced with Welded Wire Fabric.

Concrete pipe manufacturers insist on top-quality reinforcing, meeting rigid specifications—that's why

so many of them use American Welded Wire Fabric. This quality product, with its machine-made accuracy, assures the proper distribution of steel. It is prefabricated from cold-drawn, 60,000 psi yield strength wires. All intersections are electrically welded to assure mechanical anchorage in the concrete. Wire diameters as large as 0.505" on 2", 3" or 4" centers can be furnished. Its rigid specifications assure superior reinforcement.

Write American Steel & Wire, Dept. 9324, 614 Superior Avenue, N.W., Cleveland 13, Ohio for complete technical literature. *USS and American are registered trademarks*

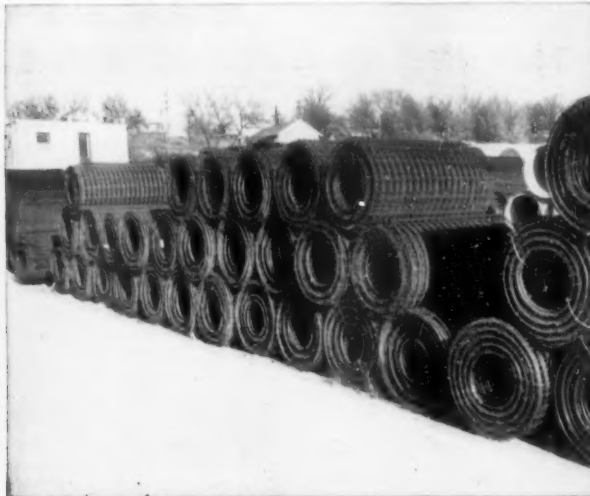


**American Steel & Wire
Division of
United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad



Sections of concrete pipe go in place more quickly and with no job interruptions. Its uniform size insures tight joints and proper alignment.



USS American Welded Wire Fabric, with its small diameter, closely spaced steel members, distributes load stresses evenly throughout the concrete pipe. It is the ideal concrete pipe reinforcement, easily formed to proper cage diameters.



American Welded Wire Fabric



CONSERVATIVE DESIGN is one of the important reasons why American Concrete Cylinder Pipe has gained such high acceptance by engineers and water works officials in the west. The composite design of the pipe is based on a factor of safety of $2\frac{1}{4}$ at the elastic limit of the pipe. American Concrete Cylinder Pipe will safely withstand sudden and severe increases of pressure — surge and water hammer — or the occasional concentrated external loadings met under unusual field conditions.

The composite action of the mortar lined steel cylinder, circumferential rod reinforcement and external mortar coating

accounts for the consistently successful performance record of this type of pipe. The use of a minimum of 25% to, under certain conditions, 50% or more of the total required cross-sectional steel area as tension-wound circumferential reinforcement substantially increases the pipe's external supporting strength over that which would be obtained if all of the required steel area were placed in the cylinder alone.

Take advantage of American Concrete Cylinder Pipe's greater inherent strength through more effective use of materials — see an American sales engineer when planning your next project.

CONCRETE PIPE FOR MAIN WATER SUPPLY AND TRANSMISSION LINES

American
PIPE AND CONSTRUCTION CO.

LOS ANGELES: 4635 Firestone Blvd., South Gate, Calif. — LOrain 4-2511 • HAYWARD: P.O. Box 630 —
JEfferson 7-2072 • SAN DIEGO: P.O. Box 13 — CYpress 6-6166 • PORTLAND: 518 N.E. Columbia Blvd.
— BUTler 5-2531 • ALBUQUERQUE: P.O. Box 1782 — CHapel 7-0486 • PHOENIX: American Concrete
Pipe Co. (Subsidiary) P.O. Box 12127 — Alpine 2-7566

MUELLER®

*Products and people,
dependably serving
every water and gas
distribution system —
for over a century!*

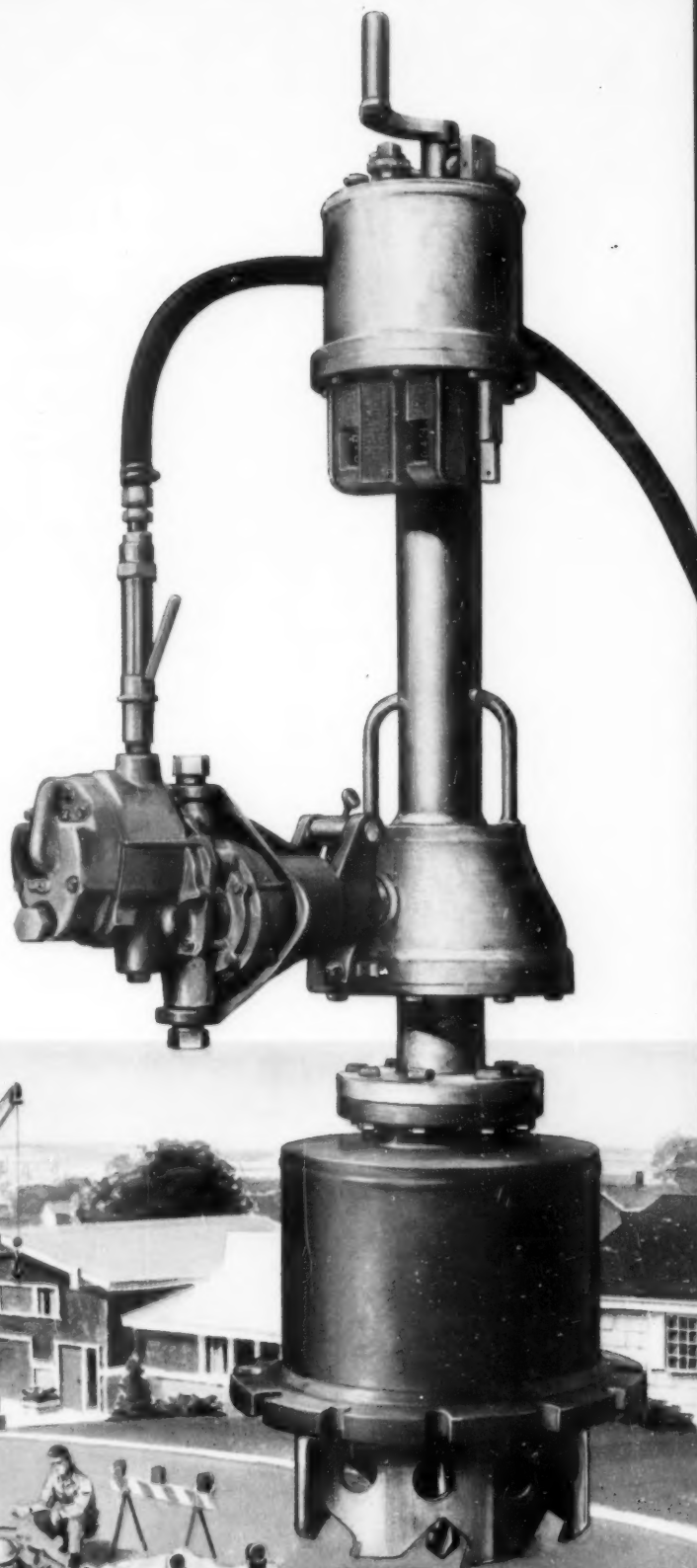
Supplying a constant flow of water and gas to your home or your industry requires highly specialized tools and equipment.

For example, this Mueller automatic drilling machine is used to drill into mains to make new connections and to add valves while the main is under pressure — *without shutting off the flow of water or gas*. The operator needs only to check the visual indicators to see how the automatic cut is progressing.

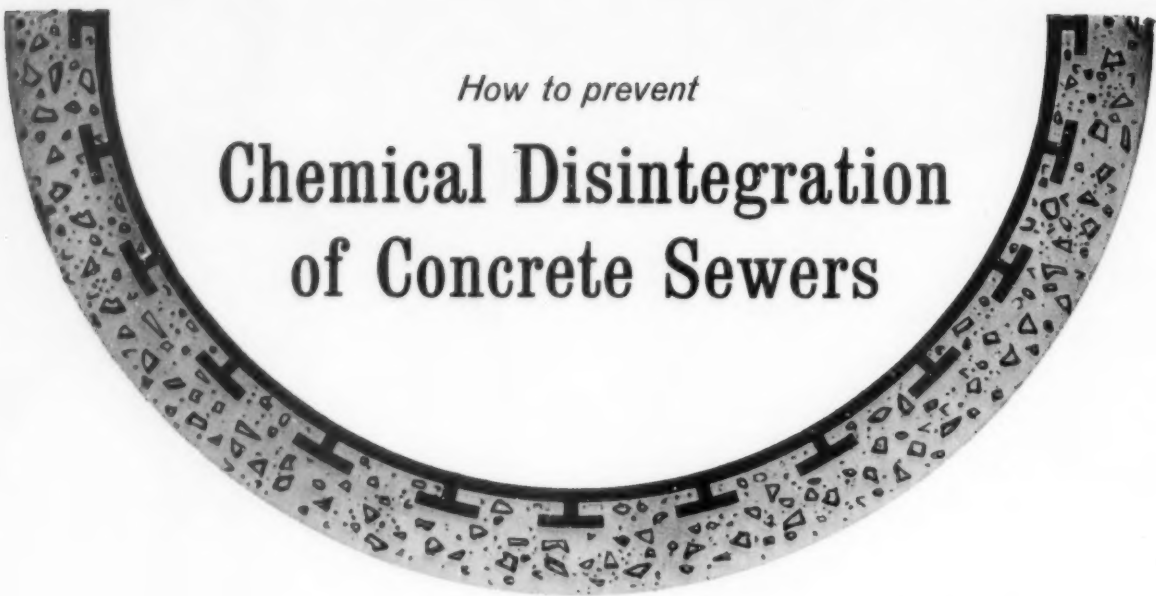
Today, because of the dependable performance of the thousands of products developed by Mueller people for the water and gas industries, the constant, safe control of gas and water is taken for granted.

MUELLER CO. DECATUR, ILL.

Since 1857



CL-12 Drilling Machine
for cuts from 2" to 12".



How to prevent

Chemical Disintegration of Concrete Sewers

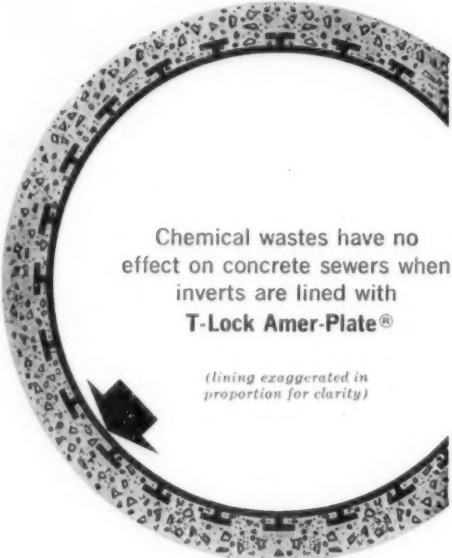
T-Lock Amer-Plate is a high polymer PVC sheet, easily cast into pipes, tunnels and structures to form a partial or complete 360° protective lining. Used in inverts, it permanently protects concrete from corrosive chemical effluents. In arch areas, it positively stops oxidized H₂S corrosion. T-Lock is also highly abrasion resistant; impartial tests show that it abrades at only 1/70th the rate of concrete.

The fact that T-Lock ends erosion and corrosion problems in industrial and municipal sewer systems is attested to by more than five million square feet now in use.

WRITE FOR THIS FREE DATA

Any of the following printed pieces may be obtained without obligation by writing to Amercoat Corporation at the address shown below. Perhaps the information contained will prove helpful to you when designing your next sewer.

- BROCHURE:** T-Lock Amer-Plate, locked-in protective lining for concrete pipe, tunnels and structures.
- LIST:** Sewers in which T-Lock Amer-Plate has been installed, including names of purchasing bodies, locations, dimensions and dates.
- REPRINT R-6:** Wichita's new sewer is plastic lined to protect concrete from sulfide gas (Kansas Construction Magazine).
- REPRINT R-7:** How T-Lock was applied to a cast-in-place concrete sewer tunnel (Engineering News-Record).
- REPRINT R-10:** How City of Los Angeles protects new sewer against corrosion (Water & Sewage Works and Public Works).
- REPRINT R-15:** Try these tricks for faster lining of sewer tunnels (Construction Methods & Equipment).



Chemical wastes have no effect on concrete sewers when inverts are lined with **T-Lock Amer-Plate®**

(lining exaggerated in proportion for clarity)

Applicators strategically located throughout U.S. and Canada



Dept. BK • 4809 Firestone Boulevard
South Gate, California

- 921 Pitner Avenue • Evanston, Illinois
- 360 Carnegie Avenue • Kenilworth, New Jersey
- 2404 Dennis Street • Jacksonville, Florida
- 6530 Supply Row • Houston, Texas

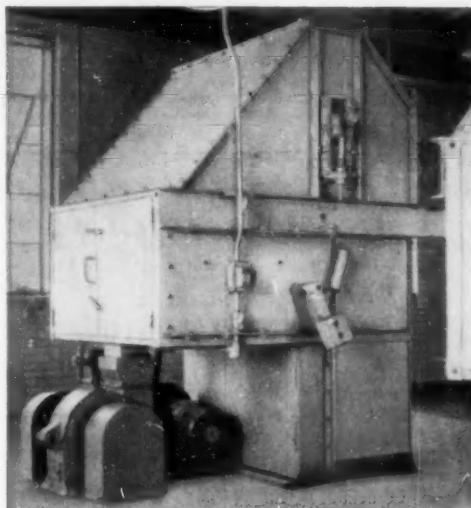
118 4

WHICH SCREEN *is best for your job?*

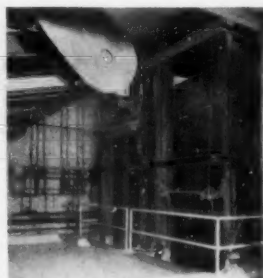
LINK-BELT builds a complete line for efficient removal of solids

COARSE?

Link-Belt coarse screens, commonly known as bar screens or racks, are preferred in water, sewage and industrial waste treatment plants where the water contains a considerable volume of large solids that might damage or clog subsequent equipment. They consist of a series of parallel bars in the flow channel—either vertical or inclined.

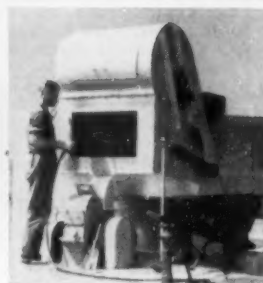


THRU-CLEAN BAR SCREENS. Automatic, chain operated rakes clean from down-stream side . . . eliminate jamming by debris. Vertical or inclined bars.



STRAIGHTLINE BAR SCREENS.

Automatic, jam-proof, cable-operated rake cleans from up-stream side, assures clean, positive screenings removal.

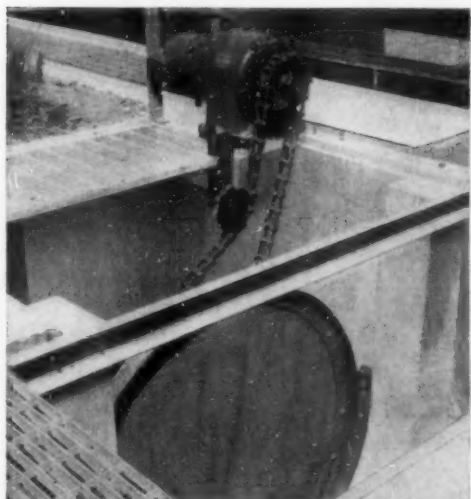


TRITOR SCREENS.

Combined screen and grit chamber saves smaller plants the cost of separate units to remove large solids and grit.

FINE?

Link-Belt fine screens provide for efficient removal of small solids. They protect subsequent equipment, prevent pollution of streams and often recover valuable products. These screens use a relatively fine mesh cloth making them applicable to water intakes, industrial waste treatment and industrial solids recovery.



REVOLVING DISC SCREENS. For applications similar to rotary drum screens, but where volume is less. Easily installed.



ROTARY DRUM SCREENS. Effectively remove fine solids from large volumes of water. For fixed water level installations.



LIQUID VIBRATING SCREEN. For thorough removal and dewatering of fine solids with minimum blinding of screen cloth.



Efficient water and waste treatment begins with a Link-Belt screen. This broad line is your assurance of an impartial recommendation based on the specific nature of your waste. For more data, contact your nearest Link-Belt office or write for Screening Equipment Book 2587.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World.

19,010

Books and Reprints For Your Engineering Library



\$7.25

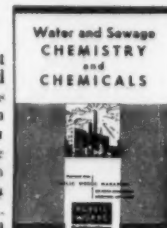
A-1

Water Supply and Purification By W. A. Hardenbergh

Among the major changes introduced in this latest edition are the following: The chapters on ground water, on filtration, and on laying pipe and maintaining lines have been almost completely rewritten; the chapters on pipe conduits and on disinfection have been revised to bring the material in them up-to-date; and a new chapter has been added on fluoridation. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle A-1 on the coupon.

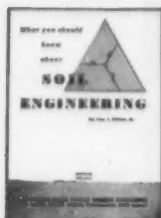
Water and Sewage Chemistry and Chemicals

If you are not an expert chemist but want a dependable text on chemistry as applied to sewerage and water works—send for this valuable reprint today. Written in plain language so anyone can understand it. Four color illustrations are used to show the exact nature of colorimetric reaction in some specific laboratory tests—something that is possible only with this type of work. Of special interest to water or sewage plant operators. To order your copy circle number A-2 on the coupon.



\$1.00

A-2



\$1.00

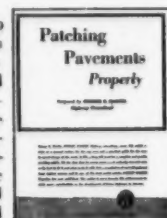
A-3

What You Should Know About Soil Engineering

Soil Engineering is the practical application of engineering principles to problems involving the use of soil, either in its natural condition or as a construction material. In this authoritative booklet all phases of soil engineering are treated in simple, easily understandable language. Full information is provided on basic soil properties, classification systems, field and laboratory tests, frost action and compaction. Liberally illustrated and containing many special charts and graphs. To order your copy circle A-3 on the coupon.

Patching Pavements Properly

Designed as a general review for the top men and a practical guide for the men in actual charge of the work. Written in down-to-earth language for easy understanding and application. Fills a long felt need for a complete and precise patching article. All types of pavements and all kinds of patching material and equipment are described and illustrated in considerable detail. Among the many subjects discussed are the general causes for failure; the various materials and equipment used in patching; and the process of making the patch. To order your copy circle number A-4.



\$1.00

A-4



\$2.00

A-5

ALGAE of Importance in Water Supply

This major article was prepared in close collaboration with U.S. Public Health service authorities. It includes, for the first time in magazine history, full and accurate color plates for the identification of types of algae most important in water supplies—those which cause taste and odors, clog filters or are likely to be found in clean or polluted waters. Color plates of this quality have never before been available to simplify the job of algae identification. To order your copy circle A-5 on the coupon.

Sewerage and Sewage Treatment

By W. A. Hardenbergh

An authoritative yet simple treatment of the subject by one of the nation's foremost authorities. Mr. Hardenbergh's editorial and field work has brought him in close contact with the problems that trouble the average engineer and in this book he explains those methods most suitable for general use. Special attention is paid to sewerage systems, both storm and sanitary. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle A-6 on the coupon.



\$7.25

A-6



\$1.00

A-7

The Operation of Sewage Treatment Plants

This valuable text has been completely revised, expanded and brought up to date. In it all phases of Sewage Treatment Plant operation are treated in simple, easily understandable language. Among the many subjects covered are: measurement flow; concentration and temperature; sampling sewage for analysis; laboratory determinations; purposes of treatment; operation of grit chambers; operation of screens; trickling filter operation; filter fly control; disposal of sludge; etc. To order your copy circle A-7 on the coupon.

The Operation of Water Treatment Plants

Here in one place you have the basic information concerning all phases of plant operation. Even those without previous technical school education will find it easy to learn from this valuable text. Completely revised, expanded and brought up to date by Clayton H. Billings, Associate Editor of Public Works. This reprint is of special interest to Water Works Superintendents, Water Treatment Plant Operators and everyone connected with the Water Works field. To order your copy circle A-8 on the coupon.



\$1.00

A-8

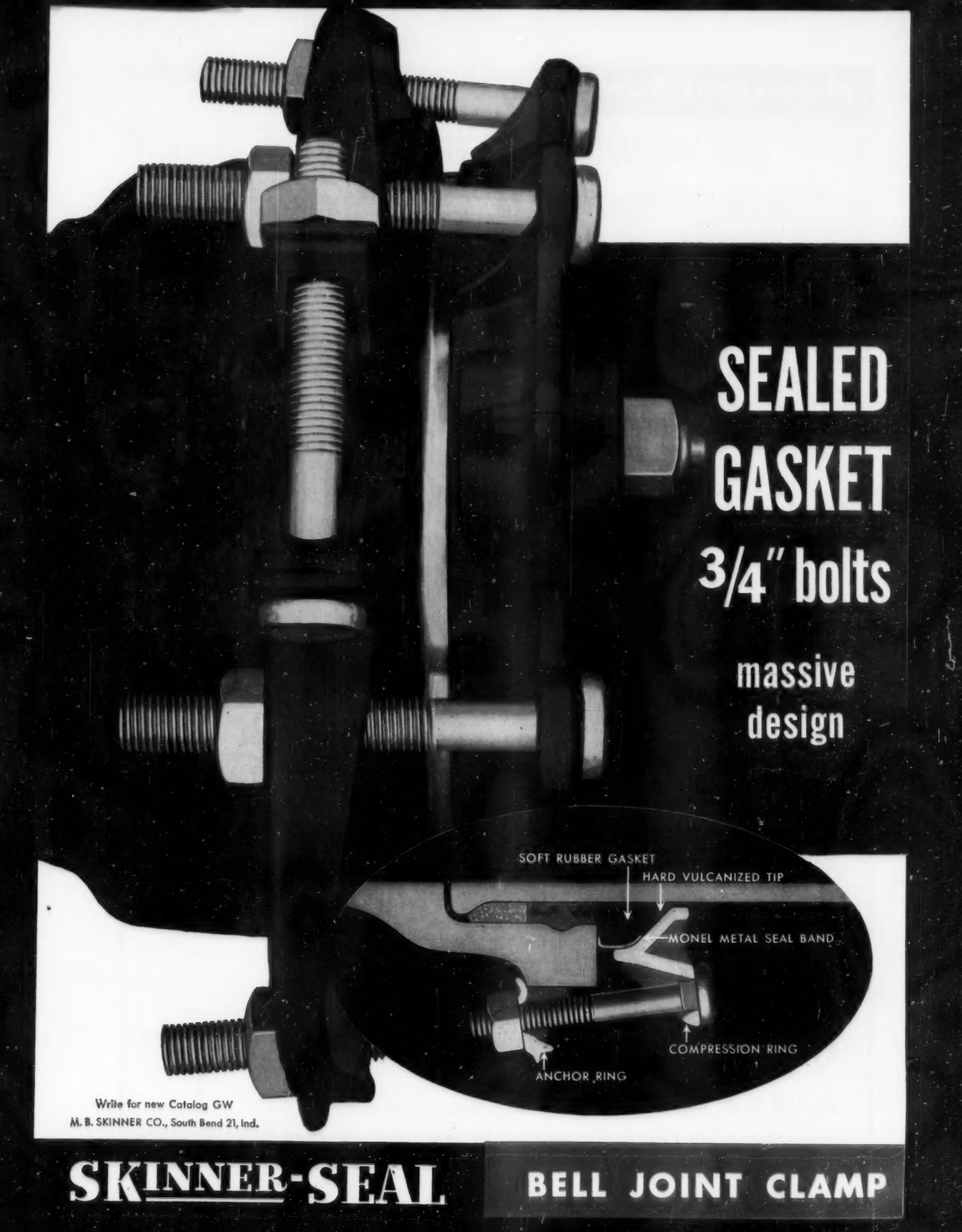
PUBLIC WORKS Magazine
200 So. Broad St., Ridgewood, N. J.

A-1 A-2 A-3 A-4 A-5 A-6 A-7 A-8
(\$7.25) (\$1.00) (\$1.00) (\$1.00) (\$2.00) (\$7.25) (\$1.00) (\$1.00)

I enclose \$..... for which please send me postpaid the books I have circled above.
I understand I may return any of them within ten days for full refund if not satisfied.

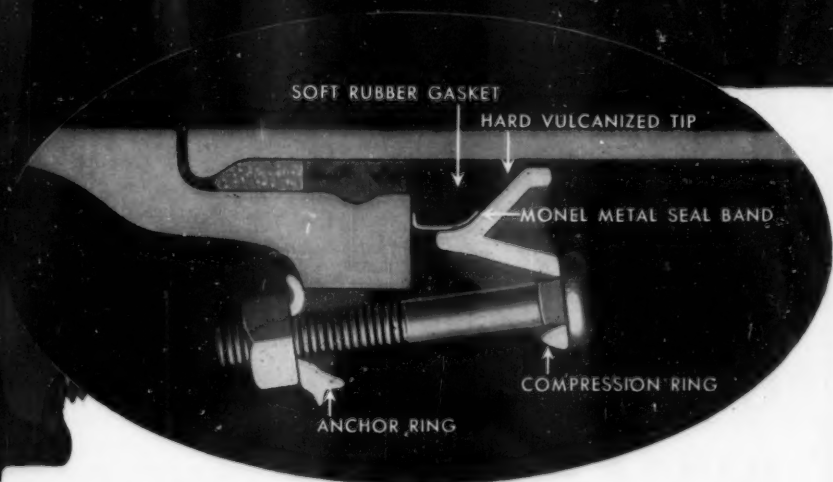
Name
Title
Address
City Zone State

**PUBLIC
WORKS**
Publications



SEALED GASKET 3/4" bolts

massive
design



Write for new Catalog GW
M. B. SKINNER CO., South Bend 21, Ind.

SKINNER-SEAL

BELL JOINT CLAMP

Municipal Power

HOW COST TRENDING HELPS YOU BUY AT THE RIGHT TIME

BRUCE J. ENNIS

Principal Engineer,
Burns & McDonnell Engineering Co.
Kansas City, Missouri

WHENEVER a major capital investment is contemplated for electric utility additions or extensions, it is advisable to study fiscal trends to determine in advance the proper timing for incorporating such improvements into the system. In view of the very large investments required for electric system equipment, the upward or downward trends of revenue bond interest rates, the trends of plant equipment contract escalation, and the trends of major equipment bid prices all have a bearing on the capital costs and fixed charges associated with the plant improvement.

For example, the timing for the sale of a revenue bond issue, to ob-

tain the funds necessary for a major system improvement, will have a considerable effect on fixed charges. With many bond issues running into millions of dollars, a variation of only a small fractional percentage in the average interest rate will be reflected in the appreciable sum of money which may be retained, or which will have to be spent for interest charges until the bonds reach maturity. Accordingly, it is a matter of great importance that every effort be made to issue revenue bonds at a time when the municipal bond market's yield index is low.

When major equipment is purchased, such as a turbine generator or a boiler, the equipment contracts usually contain escalation clauses based on United States Bureau of Labor Statistics published data for wholesale prices of steel mill products, and average hourly earnings

for electrical machinery labor and primary metals industry labor. Depending on industrial conditions, escalation payments on large items of equipment may accrue to considerable sums of money.

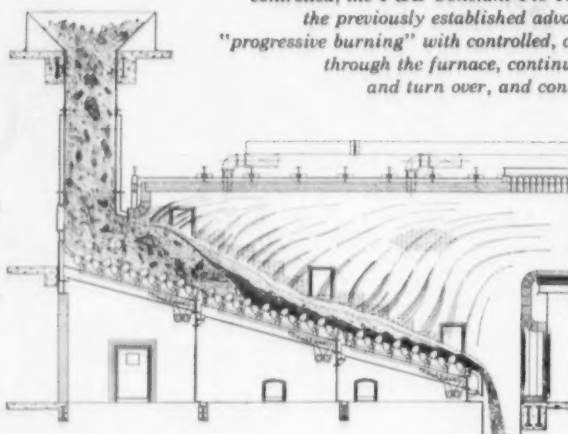
Generally speaking, manufacturers' published prices for equipment go up or down, in a rising or falling price market, in incremental steps which do not conform at all times with escalation trends. In other words, published prices generally contain a certain amount for possible price escalation subsequent to the purchase of the equipment.

In view of the many variables associated with the financing of major plant additions, it is sometimes the practice for a municipality to place orders such as for a turbine generator and a boiler (essentially long-time fabrication equipment) and enter into purchase contracts

F & E Constant-Flo Incinerator Stoker

Companion Stoker—F & E Multi-Cell Incinerator Stoker

In addition to the F&E Multi-Cell Incinerator Stoker, the Flynn and Emrich Company now offers for those municipalities desiring the continuous flow type of operation, the F&E Constant-Flo Incinerator Stoker, using the latest application of our tried and proven F&E stoker principles. Write today for brochure or plans.



Through automatic operation, electronically controlled, the F&E Constant-Flo Incinerator Stoker combines the previously established advantages of F&E "progressive burning" with controlled, constant flow of material through the furnace, continuous agitation, break up and turn over, and controlled residue disposal.

RESULTS —

1. Reduction of plant operating personnel to absolute minimum,
2. Higher rates of destruction with less air pollution,
3. Controlled furnace temperatures with much lower furnace maintenance than previously attainable, and
4. Refuse reduced more thoroughly at lower cost.



FLYNN & EMRICH CO. 301 North Holliday Street, Baltimore 2, Md.

Atlanta builds for the future with Armco Steel Pipe water supply lines



Atlanta is preparing now for expected industrial and residential growth by extending water lines in adjacent Fulton County, Georgia. This forward-planning has paid off for Atlanta in the past by attracting new industry with a ready source of water.

Shown above is part of the most recent 1½-mile installation of 30- and 36-inch diameter Armco Steel Pipe along Atlanta's Fairburn Road. This pipe is ⅝-inch wall thickness and was installed in 50-foot lengths. It is part of the more than 150,000 feet of Armco Pipe installed in the Atlanta area over the past five years to expand water facilities.

You too will find that Armco Steel Pipe can solve your water transmission problems. Its high strength, ductility, smooth-as-glass interior linings, and bottle-tight joints mean trouble-free water lines for years and years to come. Write us for more information on Armco Steel Water Pipe. Armco Drainage & Metal Products, Inc., 5509 Curtis Street, Middletown, Ohio.



For this Atlanta water line, lengths of Armco Pipe were joined by Dresser Couplings, with thrust lugs to take longitudinal thrust.

ARMCO DRAINAGE & METAL PRODUCTS



Subsidiary of **ARMCO STEEL CORPORATION**

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company
The Armco International Corporation • Union Wire Rope Corporation

subject to extension or cancellation without penalty to the purchaser during a stated period of time. Prior to the expiration of the cancellation privilege date, the municipality has an opportunity to sell necessary revenue bond issues at the most favorable interest rate obtainable.

To determine the economic desirability for following a procedure such as that outlined above, it is helpful to prepare estimates of future fiscal trends relating to the following:

(a) Possible future bid prices (if initial contracts are cancelled and

readvertisement of bids is required).

(b) Probable escalation if initial contracts are extended.

(c) Estimated rates of interest applicable to future revenue bond issues.

It is apparent, due to present unsettled conditions resultant from the current steel industry strike, and changing governmental policies regarding interest rates, that the precise determination of the factors listed above is impossible; however, based on published historical data, it is possible to predetermine average trends for these factors which should

provide a reasonable basis for future action with regard to contracting for, and financing major plant improvements. Published data sources for determining such trends are as follows:

(a) Bid Price Trends: Based on "Handy-Whitman Index of Public Utility Construction Costs—Trends of Construction Costs," published by Whitman, Requaardt and Associates, Baltimore, Maryland.

This publication tabulates cost indexes for all types of building construction, and electric light and power construction, including trends from 1912 to the present date for such items as reinforced concrete building construction, miscellaneous building materials, steam plant construction, boiler plant equipment, turbo generator units, transmission and distribution system equipment, power transformers and numerous subdivisional items of electric system material, labor, equipment, and construction items. Such data are tabulated for six geographic divisions in the United States, such as North Atlantic Division, South Atlantic Division, etc.

From these data, it is a simple matter to determine long time or short time percentage trends in cost indexes for turbine generators, boilers, etc. By applying such trends to current equipment prices, the possible future bid prices for such equipment may be estimated.

(b) Escalation Trends: Based on "Monthly Labor Review, United States Department of Labor, Bureau of Labor Statistics," Washington, D. C.

This publication lists indexes of wholesale prices by major groups and subgroups of commodities, and average hourly earnings of workers by industrial classification and by various manufactured products clarifications. Based on the stipulations of particular contract escalation clauses, it is possible to prepare estimates of probable future escalation requirements using trends compiled from these Department of Labor data.

(c) Revenue Bond Interest Rates: Based on weekly information and graphs published by the "Wall Street Journal," New York City, on "Tax-Exempt Municipal Bonds."

These data consist of the tax-exempt bond yield for the monthly average of twenty 20-year bonds, covering the current year plus the three preceding years of record, by months. Use of these data permits the extrapolation of trends on estimated future average interest rates for municipal bonds.

Stop costly infiltration in storm drains and sewer lines with the famous **CENTRILINE PROCESS**



Centrilineing is effective in diameters from 6" to 144"

The Centriline Process of centrifugally applying a cement-mortar lining to pipes in place can be as effective in preventing infiltration in sewer and storm lines caused by external pressures as it is in permanently eliminating leakage in water mains caused by interior pressures and corrosion. Infiltration means over-taxed pipe line capacity and higher costs for treatment and disposal. Infiltration also results in the settlement of streets and other surfaces. Centriline's 6 million feet of pipe rehabilitation

experience is on call to help with these problems.

Lining is placed when infiltration has been stopped by natural lowering of water table, plugging leaks from the interior, or by well pointing. A qualified Centriline engineer will be happy to discuss our quick and economical method of repairing concrete and terra cotta storm drains and sewer lines in sizes from 6" to 144". For further information, write today for your copy of our free booklet which fully describes the Centriline Process.

CENTRILINE CORPORATION

A Subsidiary of Raymond International Inc.

140 Cedar Street
New York 6, N. Y.
WO 4-1429

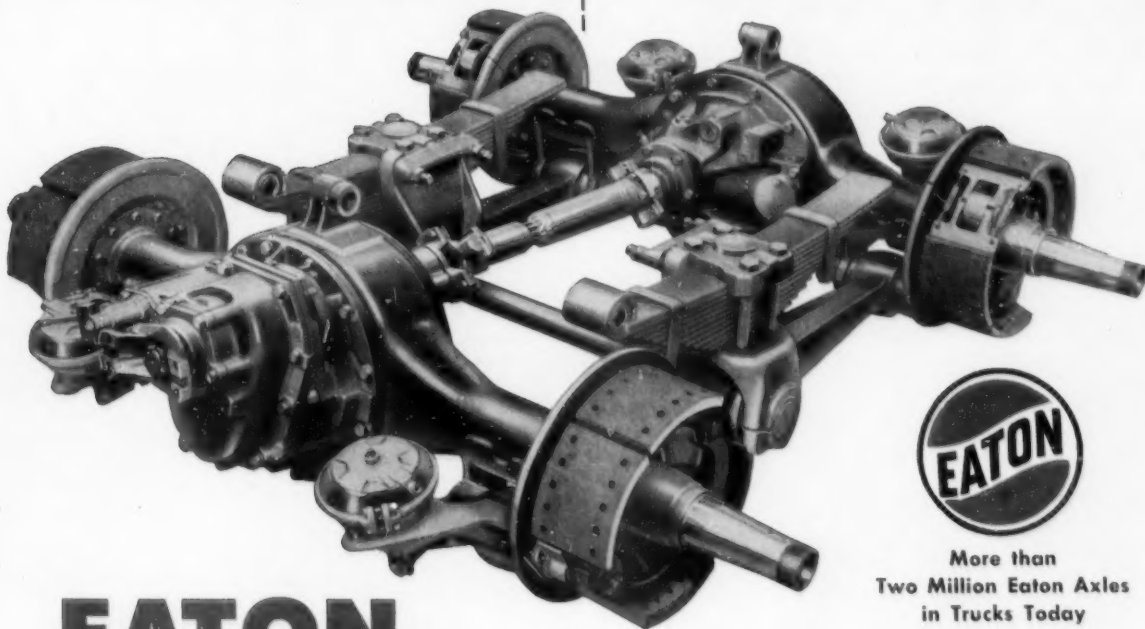


Branch Offices in Principal
Cities of the United States,
Canada and Latin America.

**30D
SERIES**

**42D
SERIES**

**Two New Additions
to the Expanding Line of**



EATON TANDEM AXLES

**Provide Famous Eaton Design
in a Wider Range of Sizes**

Two new Eaton Tandem Axle models now extend the line of famous Eaton Tandems into a much wider range of vehicle capacities—from 38,000 lbs. GVW to 55,000 lbs. GVW.

Eaton Tandem Axles offer advantages not available in other tandems. Included are important savings in weight and over-all length with no sacrifice of stamina. These operation-proven axles may be selected

from Single Speed, 2-Speed, and Double Reduction types. The 2-Speed and Planetary Double Reduction models provide the many advantages of Eaton's exclusive planetary gearing design—substantiated by billions of miles of economical, trouble-free service.

Ask your truck dealer to explain the 10 big benefits you get with Eaton Tandem Axles—and how they can make your hauling operations more profitable.

EATON

AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO, U.S.A.



**BUILDING NEW
SEWAGE LIFT STATIONS?**

Be sure of
Continuous
operation
during Power Failure!



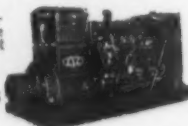
WITH **Katolight** EMERGENCY
ELECTRIC POWER PLANTS

When normal electric power fails, Katolight Power Plants take over instantly, assuring uninterrupted electric power to operate sewage lift station pumps, water pumping stations, other vital equipment.

Whether your municipal requirements call for portable, standby, or continuous power, Katolight Power Plants are your answer. Katolight is experienced and equipped to meet all standard and special applications up to 1200 KVA.

Katolight's advanced features assure dependable long life . . . low cost operation.

WRITE REGARDING
YOUR REQUIREMENTS




Katolight CORPORATION

Box 891-107

Mankato, Minnesota

**DRILL CONCRETE
IN SECONDS**

Instead of
Hours with **PENNDRILL**



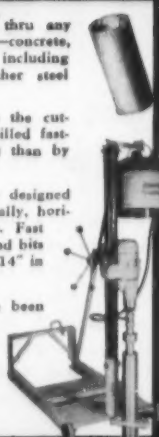
Holes can be drilled thru any type masonry material—concrete, marble, brick and tile; including reinforcing bars or other steel encountered.

Using diamond bits as the cutting agent, holes are drilled faster and at a lower cost than by any other method.


Penn Drill equipment is designed for drilling holes vertically, horizontally or at any angle. Fast cutting, long life diamond bits in stock from 3/16" to 14" in diameter.

Millions of holes have been drilled with Penn Drill bits, cutting job costs up to 60%.

Write for illustrated literature.



**PENNSYLVANIA DRILLING CO.
MASONRY DRILL DIVISION**
1201 Bankville Road, Pittsburgh 18, Pa.



**LEGAL ASPECTS
OF
PUBLIC WORKS**

MELVIN NORD, Dr. Eng. Sci., LL.B.

Dynamite in the Zoo

Crisafi v. City of Cleveland, 158 N.E. (2d) 379, an Ohio case decided April 22, 1959, was an action for damages for injuries to the property of the plaintiff caused by subterranean tremors resulting from dynamite in a nearby public zoo.

The argument of the plaintiff was that the dynamiting was a public nuisance, hence there could be no immunity from tort liability.

The court held, however, that the liability of a municipality in nuisance (constituting an exception from the general rule of immunity for governmental activities in connection with public grounds) applies only in favor of persons using the public grounds for the purposes for which they were created. Thus, the court held that there was no liability on the city in this case arising out of its activities in connection with the development and improvement of a public park.

**Condemnation of Land
for Highways**

In re Ziegler's Petition, 97 N. W. (2d) 748, a Michigan case decided July 13, 1959, was a proceeding by the Michigan Highway Department for condemnation of land for highway purposes.

The Dake Corporation, located in Grand Haven, Michigan, manufactures arbor and hydraulic presses. Since 1953 its annual business has exceeded \$1,250,000, and in 1956 approximated \$1,900,000.

The factory is built on a rectangular parcel of land with an area of approximately 5 acres, with 11 buildings, plus a loading dock, concrete driveways, and fences.

In order to widen US-31, the highway department of the State of Michigan condemned a strip of land involving four buildings, resulting in Dake's loss of 40% of its manu-

facturing floor space and 17% of its land area, forcing Dake to move its entire productive facility to a new location.

In the condemnation proceedings, Dake sought compensation for (1) damage to land and buildings, (2) expense occasioned by business interruption, and (3) the expense of relocating machinery and equipment. The award included these items, and the Highway Department appealed.

The principal issue on appeal was whether it was proper to include the cost of removing and relocating machinery and equipment. The Highway Department contended that it has not "taken" this equipment, and therefore should not have to pay for it.

The Michigan Supreme Court held that this was nevertheless an item of damage, because of the resulting decreased market value of the property after the taking of part of the land, and affirmed the entire award.

Merry-Go-Round

Carr v. City and County of San Francisco, 338 Pac. (2d) 509, a California case decided April 30, 1959, was an action for injuries sustained by a child who was injured when he tripped over the foot of an attendant in charge of a merry-go-round in the city's park.

The merry-go-round is located in an area which contains swings, slides, an animal corral, a donkey ride, and a food concession. The accident occurred when the attendant was stepping on the merry-go-round to get the children prepared for the next ride.

The court held that in the operation of a playground for children a municipality is performing a governmental and not a proprietary function. The court refused to hold that this was an activity designed



CreZon Keeps Our Sign Budget Down



Many attractive and functional street signs seen in Dallas, Texas, are made from U.S. Plywood's Duraply.

I didn't have to recommend an increase in our sign budget this year—thanks to CreZon overlaid plywood. It really helped us cut our costs. For instance . . .

The smooth, grainless CreZon surface is easier to paint. Paint goes on faster, stays on longer. And it's easier to saw and drill because it doesn't split or crack.

But that's not all! These light-weight signs are easier to install *and* require less maintenance. The tough, durable CreZon surface stays smooth and good-looking for years. Damage by vandals is less of a problem, too.

If you'd like to produce more—and better—signs for less money, I'd suggest you start using CreZon overlaid plywood in your sign shop.

Order CreZon from your regular plywood supplier under these brand names: Super Siding, G.P.X., Armorite, Duraply, Everside, Plyaloy, CreZon Overlaid Plywood.



CROWN ZELLERBACH CREZON SALES

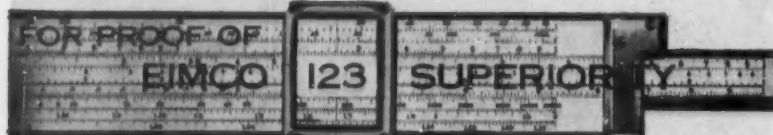
In Canada address product inquiries to Crown Zellerbach Canada Limited, Vancouver, B. C.

COMPARE THE NEW
EIMCO 123
FRONT END LOADER!
CHECK THE



NOT THE CLAIMS

| | EIMCO 103 | CAT D-4 | CAT D-6 | AC HD-6 | AC HD-11 | INT. TD-9 | INT. TD-18 | CASE 1000 |
|---|-----------|---------|---------|---------|----------|-----------|------------|-----------|
| Maximum Drawbar Pull, Pounds (zero track slippage) | 33,600 | 10,700 | 19,000 | 15,485 | 21,980 | 13,340 | 23,790 | 34,000 |
| Torque Converter | Yes | No | No | No | No | No | No | Yes |
| Master Clutch | No | Yes | Yes | Yes | Yes | Yes | Yes | No |
| Power shift transmission on all speeds, with oil-cooled metallic clutches that never need adjustment | Yes | No | No | No | No | No | No | No |
| Independently reversible track | Yes | No | No | No | No | No | No | Yes |
| Hydraulic track take-up | Yes | No | No | No | No | No | No | Yes |
| Heat-treated alloy steel grouser shoes, keyed to the track links | Yes | No | No | No | No | No | No | No |
| One-piece heat-treated alloy steel track rollers, tapered roller bearings | Yes | No | No | No | No | No | No | No |
| Equalizer bar of heavy duty heat-treated cast alloy steel, allowing full oscillation of crawler tracks with all attachments | Yes | No | No | No | No | No | No | No |
| Constantly running power take-off drives, front and rear, to standard SAE specs. with rear take-off not affected by track operation, and independent hydraulic pump drive allowing simultaneous use of hydraulic, winch and hoist accessories | Yes | No | No | No | No | No | No | No |
| Front operator's seat for full visibility | Yes | No | No | No | No | No | No | No |
| Ability to operate forward and backward on up to 90% slopes | Yes | No | No | No | No | No | No | No |
| Tractor guaranteed for one full year of single shift service | Yes | No | No | No | No | No | No | No |



| | EIMCO 123 | CAT 955 | CAT 972 | AC HD-6G | AC HD-11G | INT. 9K3 | INT. 15K3 | CASE 1000 |
|----------------------------------|-----------|---------|---------|----------|-----------|----------|-----------|-----------|
| WEIGHT, POUNDS | 25,000 | 22,470 | 34,915 | 19,600 | 32,000 | 19,985 | 33,225 | 21,800 |
| ROCK BUCKET, CU. YARDS | 1 3/4 | 1.1 | 1.8 | 1 1/4 | 2 1/4 | 1 1/2 | 2 1/4 | N.A. |
| ENGINE HP | 100 | 70 | 100 | 72 | 111 | 71 | 113 | 100 |
| TRACK GAUGE, INCHES | 60 | 60 | 74 | 60 | 74 | 60 | 74 | 60 |
| SHOE WIDTH, INCHES | 17 | 15 | 18 | 13 | 16 | 15 | 18 | 14 |
| LENGTH OF TRACK, INCHES | 88 | 81 3/4 | 105 3/4 | 83 3/4 | 106 3/4 | 75 | 98 3/4 | 79 |
| TRACK AREA, SQ. INCHES | 3,000 | 2,450 | 2,814 | 2,180 | 3,410 | 2,250 | 3,546 | 2,530 |
| GROUND PRESS., PSI | 8.3 | 9.2 | 9.2 | 9.0 | 9.4 | 8.9 | 9.4 | 8.4 |
| LIFT HEIGHT TO HINGE PIN, INCHES | 144 | 128 | 144 | 120 | 139 | 125 | 144 | 134 |
| DUMP HEIGHT, INCHES | 115 | 100 | 114 | 96 | 114 | 102 | 113 | 101 |
| DUMP REACH, INCHES | 44 | 38 3/4 | 39 | 31 | 37 | 26 | 37 | 40 |
| MAX. DUMP ANGLE, DEGREES | 63 | 30 | 50 | 45 | 52 | 60 | 58 | 50 |
| MAX. PUMP PRESSURE, PSI | 1,200 | 1,450 | 1,450 | 1,000 | 1,300 | 1,500 | 1,750 | 1,450 |
| PUMP GPM | 75 | 43 | 52.5 | 39 | 72 | N.A. | N.A. | 30 |
| LIFT TIME, SEC. | 7.5 | 7.0 | 9.1 | 9.0 | 9.0 | 7.7 | 9.0 | 7.5 |
| DUMP TIME, SEC. | 3.0 | 4.0 | 5.0 | 4.0 | 4.0 | N.A. | N.A. | 1.6 |
| GROUND CLEARANCE, INCHES | 17 | 13 3/4 | 19 1/4 | 11 3/4 | 13 3/4 | 9 | 10 | 16 |

Above is from manufacturer's data and other sources believed to be reliable, but cannot be guaranteed.

"IT'S A FACT . . . not a claim . . . that here is a MODERN line of tractors that makes all other crawler-tractors old-fashioned! Other exclusive features include Unitized "Stress Flow" Construction, for far greater strength and rigidity; Self-cleaning Air Cleaner that completely eliminates ordinary routine cleaner maintenance and others, far too numerous to list here. Write for details and specifications on all the advanced engineering features of the modern Eimco 103 line of crawler-tractors.

AVAILABLE IN
FOLLOWING MODELS:

- 103 - TRACTOR AND DOZER
- 123 - FRONT END LOADER
- 133 - STEEL MILL FEL
- 143 - LOG LOADER

"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884" B-480

THE EIMCO CORPORATION

EXPORT OFFICE: 31 - 32 SOUTH STREET, NEW YORK, N. Y.

BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

TRACTOR LOADER
DIVISION

634 SOUTH 4TH WEST
SALT LAKE CITY, UTAH - U.S.A.

primarily for the amusement and entertainment of the public and hence merely a proprietary activity, saying that there is a difference between providing playgrounds for children and places of entertainment and amusement for adults (such as golf courses).

Since the activity was held to be governmental, the city was immune from liability.

On Ice

List v. O'Connor, 158 N.E. (2d) 103, an Illinois case decided May 6, 1959, involved the death of an ice skater who was struck when a motorcycle went out of control during a race on a frozen lake in a public park. The action was brought against the park district along with certain individuals.

The court held that the park district was acting in a governmental capacity in maintaining and operating the park, i.e. in permitting the motorcycle races to be run on the frozen surface of the lake.

Therefore, the park district was held to be immune from liability in this case.

Tenancy at Sufferance

Turner v. Town of Oxford, 155 N.E. 2d 182, decided by the Supreme Judicial Court of Massachusetts Jan. 9, 1959, was an action to enjoin the town and an individual defendant from operating a town dump.

The land was owned by the defendant Hudson, but he had allowed the town to use it as a public dump. It was found that he personally was not guilty of any negligence, but that papers, rubbish, and other waste materials were scattered over part of plaintiff's land.

The court held that the town had a tenancy at sufferance in the land, and should be enjoined from committing a nuisance.

• • •

City Spending and
Revenues Increase

According to the Census Bureau "Summary of City Government Finances for 1958," covering 17,000 cities, city governments spent \$13.8 billion against an income of \$12.8 billion. This does not include other local taxing districts. Both spending and income were 7 percent above 1957. At the end of the year, city debt amounted to \$20.4 billion. Municipal taxes provided nearly \$7 billion, with property tax yields up about 6 percent.



"Our improved control with POZZOLITH cuts costs on the Eglin Air Force Base job"

W. J. NOONAN, SR.,
President, Noonan Construction Co.,
Pensacola, Florida



DRY-BATCH PLANT located on the Gulf—approximately 9 miles from the job site. Most aggregates were delivered by barge from Radcliffe Gravel Co., Inc. of Mobile Alabama. Ideal Cement was also transported to the batch plant by this method.

THIS CONTRACT at Eglin Air Force Base involved the placing of 110,000 cubic yards of unreinforced concrete. Pavement ranged from 14" to 22" thickness. Supervising the job is W. J. Noonan, Jr., General Manager, Noonan Construction Co. • Curtis Sullens, Concrete Supervisor, Corps of Engineers, Mobile District • John Day, Project Superintendent, Noonan Construction Co.

"Corps of Engineer specifications called for 650 psi flexural strength with $4\frac{1}{4}\%$ $\pm 1\frac{1}{2}\%$ entrained air. We knew that with local materials and good control, a plain mix with a cement factor of about 6 sacks per cubic yard should produce this strength.

"We also knew that with POZZOLITH we could meet this flexural specification with 5 to 5.2 sacks and that POZZOLITH would provide close control of entrained air, as well as lower finishing costs. So we based our bid on using POZZOLITH.

"The job was started with a POZZOLITH mix having a cement factor of 5.8 sacks. Because of uniform strength results, well above specification, it was gradually reduced to the 5.2 sack factor which we used in our original estimates. The uniformity in batches, absence of bleeding, and exceptionally good workability kept finishing costs down. Air content was easily maintained at $3\frac{1}{2}\%$ with minor adjustments being made quickly in the field.

"The Master Builders field man worked with us from start to finish giving us the benefit of his experience. This resulted in better quality concrete at lower cost to the owner and substantial savings to us."

For lowest cost-in-place . . . superior quality concrete—there's no equal to today's POZZOLITH. Call in the local Master Builders man to demonstrate how POZZOLITH can help put you ahead on your very next job.

The Master Builders Company, Cleveland 3, Ohio

Division of American-Marietta Company

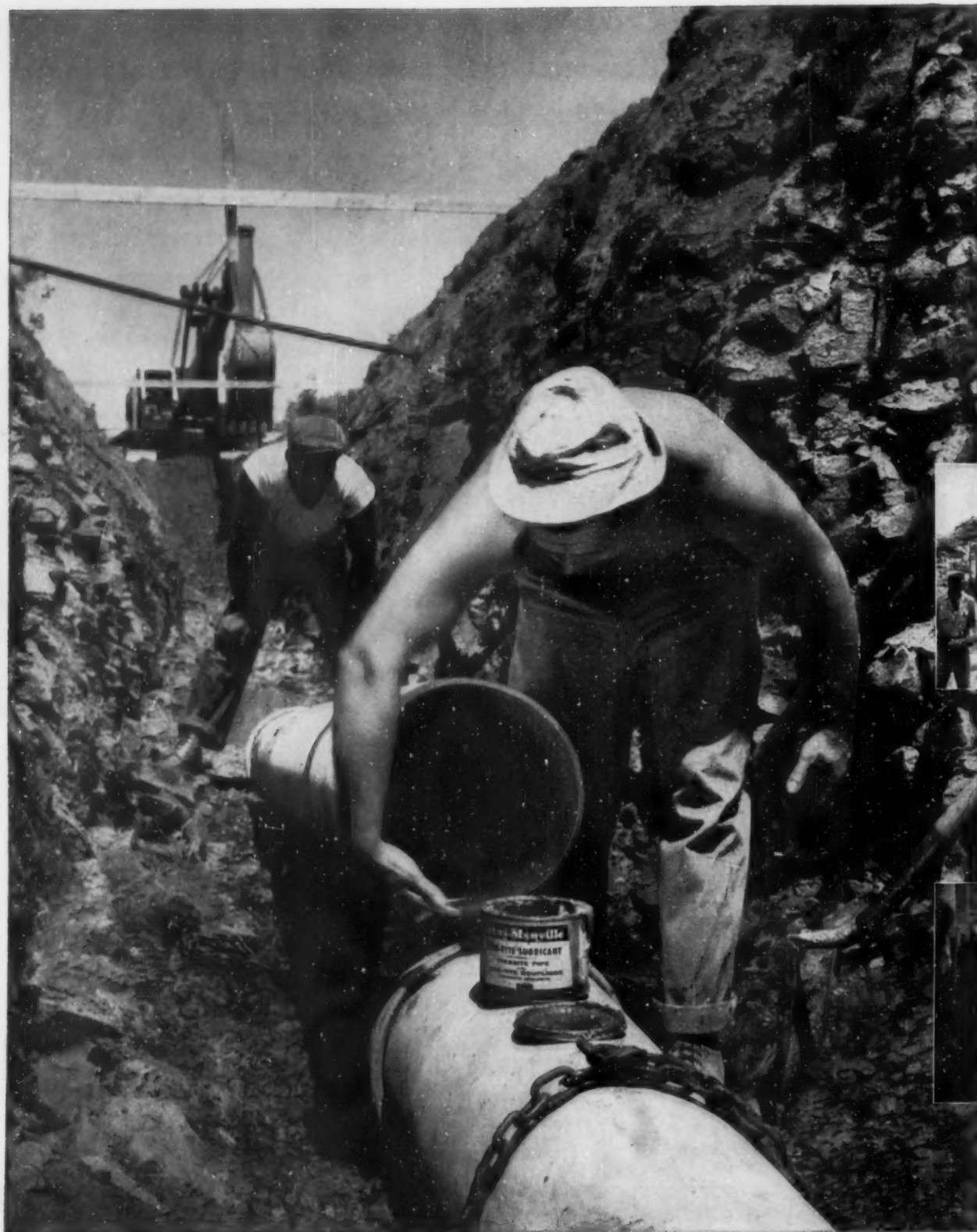
The Master Builders Company, Ltd., Toronto 15, Ontario

International Department, New York 17, New York

Branch Offices in all principal cities.

MASTER BUILDERS® POZZOLITH*

*POZZOLITH is a registered trademark of The Master Builders Co. for its concrete admixture to reduce water and control entrainment of air and rate of hardening.



"In one day we can install as much as 600 feet of 12" Transite Sewer Pipe"



Says Ernest Renda
E. Renda & Son Contracting Co.
Green Brook, N. J.

"Today the only way you can show a profit," says Mr. Renda, "is to increase your productivity—to lay more pipe per day. That's why we feel surer working with Transite". . .



Mr. Renda continues

"It is easily handled on the ground and in the trench. It is quickly assembled and installed. It reduces job site operations to such an extent that we can work with fewer men. Another important Transite advantage is tight joints . . . and there are fewer joints to

make. Never any trouble passing leakage and infiltration tests. Long Transite lengths give us a straighter line . . . better grade.

"Working with Transite gives us another advantage—the Johns-Manville installation service," he continues.

"Bob Anderson, the J-M field instructor (shown at right, center photo), constantly advises me on new methods used on other jobs. And ten years ago, it was this same instructor who taught me to assemble Transite so that I could teach my men how to install it."



Transite® Sewer Pipe installs quickly, easily to keep installed costs low . . . its smooth interior permits flatter grades . . . and the Ring-Tite® Coupling answers the toughest infiltration and root problems. Send the coupon for your copy of TR-206A—"The Book Designed with the Contractor in Mind." Mail the coupon now!

JOHNS-MANVILLE

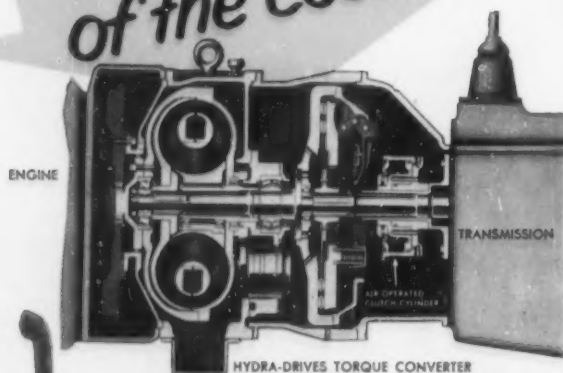


Johns-Manville
Box 14PW, New York 16, N.Y.

Gentlemen: Kindly send me the informative, 16-page Transite booklet which is written especially for contractors.

Name _____
Firm _____
Street _____
City _____
Zone _____ State _____

Now! Many Of The
Advantages Of Power
Shift Transmission
at a fraction
of the cost!



HYDRA-DRIVES®

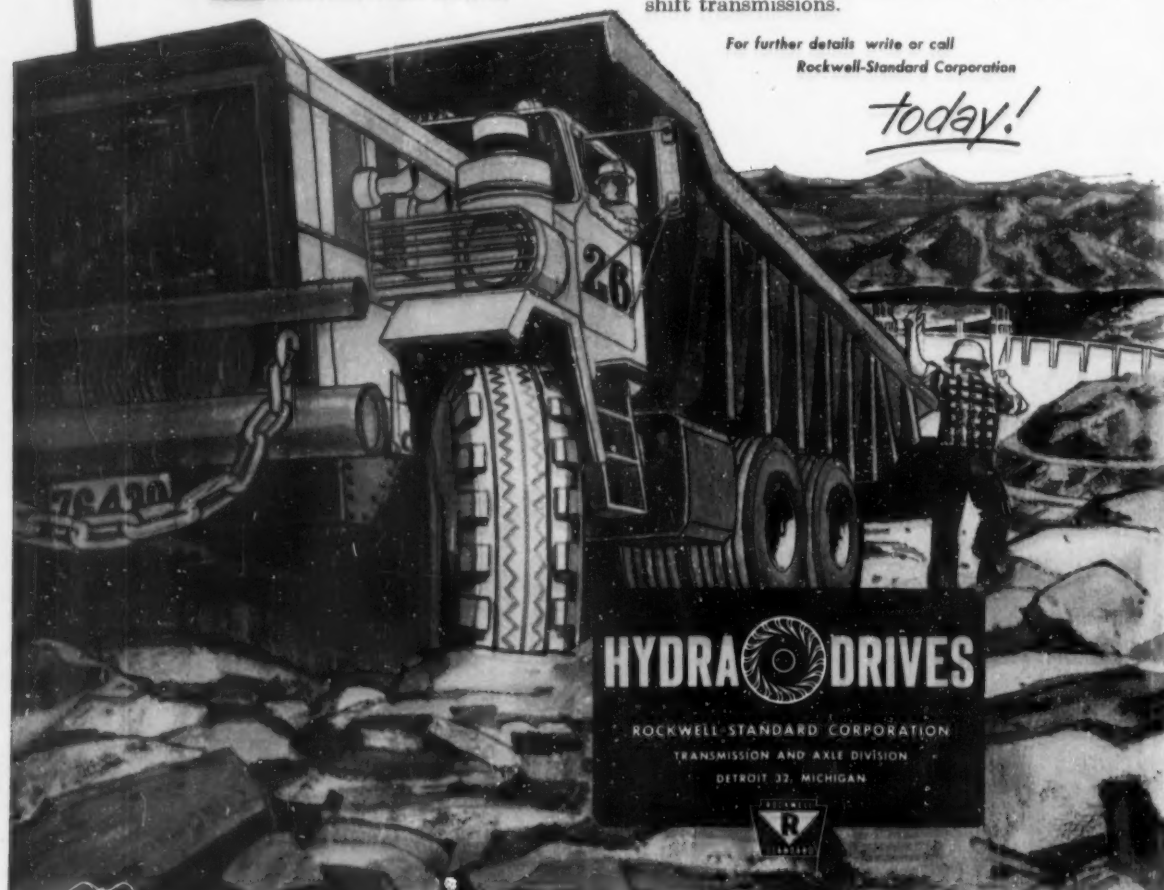
TORQUE CONVERTER WITH A STICK SHIFT TRANSMISSION!

Lower in initial costs, Rockwell-Standard's Hydra-Drives Converter with stick shift transmission reduces operating and maintenance costs on heavy-duty off-highway trucks. You get these five major advantages plus many others:

1. Up to 80% of shifting is eliminated. Select a transmission ratio to fit the haul, and let the converter handle the changing load conditions with a minimum of gearing. Any required shifting can be done while truck is in motion!
2. Greatly reduces shock loading on all drive components.
3. Clutch adjustments and wear problems minimized.
4. A minimum of driver training is required.
5. Cost is hundreds of dollars less than full power shift transmissions.

For further details write or call
Rockwell-Standard Corporation

today!



HYDRA-DRIVES

ROCKWELL-STANDARD CORPORATION
TRANSMISSION AND AXLE DIVISION
DETROIT 32, MICHIGAN



ANOTHER PRODUCT OF **ROCKWELL-STANDARD CORPORATION**

NOVEMBER, 1959

Volume 90, Number 11

SECONDARY SEWAGE TREATMENT FACILITIES

are 3½ Miles from Primary Plant

LLOYD W. WELLER

Black & Veatch,
Consulting Engineers,
Kansas City, Missouri

THE SECONDARY sewage treatment works now under construction for the City of Wichita, Kansas, are the latest step in a 30-year program to provide sewers and sewage treatment for that City. The initial step was taken in 1929 when the City authorized Black & Veatch, Consulting Engineers, to prepare a report on the problems caused by discharging the City's sewage into the Arkansas River. The primary treatment plant recommended by that report was built in 1930-1931. This plant was designed to treat sewage at the rate of 18 mgd and included a raw sewage pumping station, grit removal units, preaeration, sedimentation, separate sludge digestion and sludge drying beds.

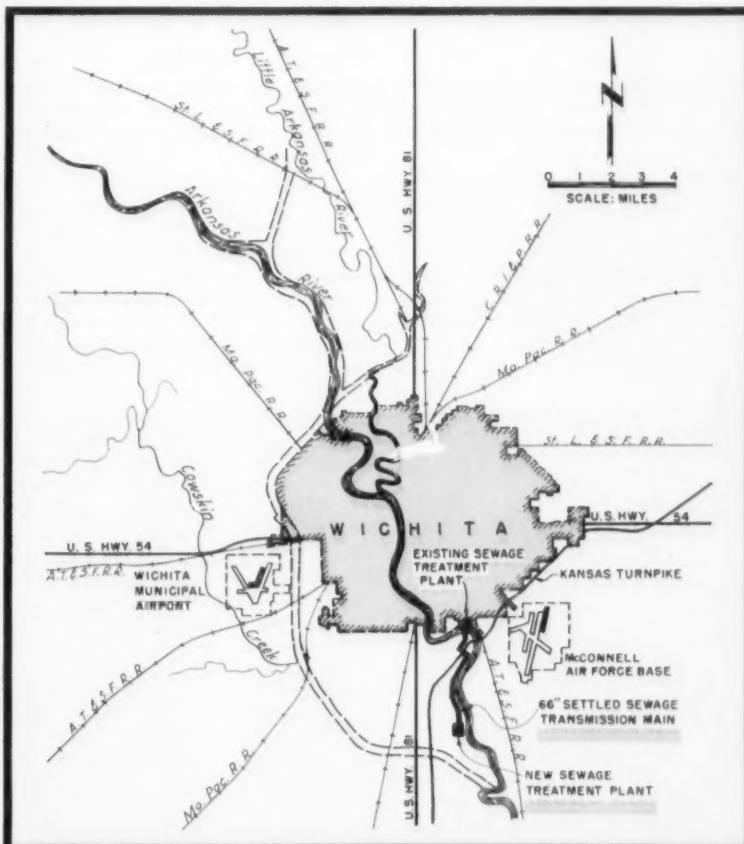
Several additions to this original primary plant have been required to keep pace with Wichita's rapid growth. The last of these additions, designed in 1953, increased the rated capacity of the plant to 36 mgd. However, the continued growth of the City and its metropolitan area had already made it apparent that more complete treatment of the City's wastes would soon be required. In 1956, Black & Veatch was authorized to prepare a long range plan covering sanitary facilities for the Wichita metropolitan area. This report included recommendations for the secondary sewage treatment facilities now under construction.

The location of these new works posed a problem since the existing plant site is limited in extent and can not be expanded because of the growth of commercial and residential developments in the vicinity. Accordingly, it was decided to locate the secondary treatment facilities, and the primary treatment

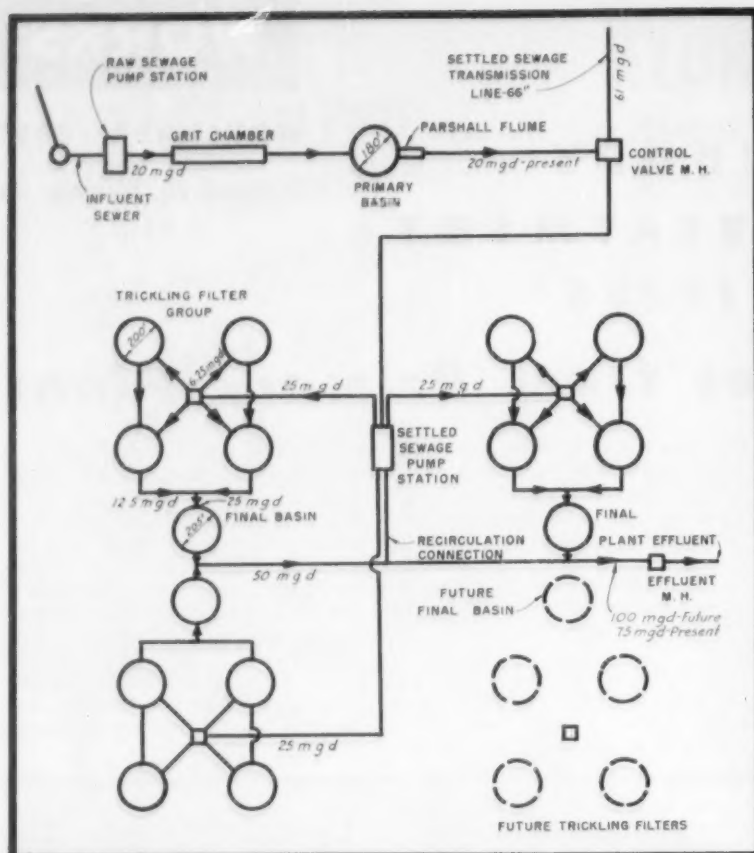
them, at a new 120-acre site in an undeveloped area approximately 3.5 miles downstream from the primary plant on the Arkansas River. As considerable development has occurred in the metropolitan area below the existing plant, the new location has the added advantage of being able to serve this downstream area.

In order to facilitate financing, the work on these improvements is being carried out in two phases. Contracts for the first phase, award-

ed December 16, 1957, include a 66-inch settled-sewage transmission main between the plants, and facilities at the new plant for secondary treatment by means of trickling filters, chemical treatment of secondary sludge, separate sludge digestion and sludge beds. The contract for the second phase, awarded January 12, 1959, includes additional secondary treatment facilities, additional sludge digestion facilities, and the first unit of primary treatment facilities.



● PARTIAL relocation of sewage treatment facilities was required by a lack of area at original site. Secondary units are connected to primary by a 66-in. line.



● FLOW diagram of the new plant showing the tie-in of the settled sewage transmission line. Each group of filters is served by a separate pump and discharge line.

The secondary treatment portion of the plant has been designed to maintain a uniform flow through the trickling filters and final basins. The design basis for all of the secondary treatment facilities being constructed under both phases of the program is as follows:

| | |
|---------------------------------------|----------|
| Flow | |
| Average Flow | 45 mgd |
| Maximum Flow | 67.5 mgd |
| Total Flow including recirculation | 75 mgd |

| | |
|--|--------------------------|
| BOD Loading | |
| Raw Sewage—Total Plant Load | 84,900 lbs. |
| Secondary Plant Load | 56,700 lbs. |
| Ultimate Unit Trickling Filter Loading ¹ | 1,000 lbs./acre-foot/day |
| Digester Capacity | 574,500 cu. ft. |

The flow to the secondary plant will be settled sewage from the existing primary plant and from the new primary treatment facilities now under construction at the new site. This settled sewage inflow will be combined with recirculated final effluent and then pumped to the trickling filters.

The trickling filter effluent will be discharged to the final basins where the settleable solids will be removed. Final effluent will be returned to the pump station at the rate required to maintain continuous operation of the pumps and the remainder of the final effluent will be discharged to the Arkansas River.

The plant is laid out on a unit basis, with each unit consisting of a group of four trickling filters and one final tank. Each of these units is served by a separate pump at the pumping station and by a separate discharge line from the pump station. The use of a separate pump and discharge line for each unit provides a positive split in the total plant flow so that all units will be equally loaded.

The maximum elevation of the river flood-protection levee adjacent to the plant site is El. 77.0 and the maximum anticipated flood water level in the river at that point is El. 74.0. The final basin weirs are set at El. 72.83 which will allow free discharge to the river approximately 96 percent of the time. During

maximum flood conditions flow will be maintained through the plant, although the final basin weirs will be submerged. This plant will assure that the settled sewage received treatment by the trickling filters at all times, and will prevent the entrance of backwater from the river into the final basins.

Settled Sewage Pumping Station

The pumping station is laid out so that a total of 5 pumps can be provided. This will enable the pumping station ultimately to serve four groups of trickling filters. Under the present contracts, only four pumps will be installed. One pump will serve each of the three trickling filter groups being constructed and the fourth pump will act as a stand-by. Each pump will be capable of delivering 25 mgd to the trickling filter group which it serves. The pumps are of the vertical turbine type with suction inlets and pump bowls submerged in the wet well. The pump drives are weather-proof vertical electric motors installed above the pump station operating floor. The pump motors are installed out-of-doors as the pumping station will not require a superstructure. The elevation of the motor bases is such that the motors will be well above maximum flood level.

Trickling Filters

Three clusters or groups of four trickling filters each, or a total of 12 trickling filters, will be provided. Trickling filters will be 200 feet in diameter with an average rock depth of 6 ft.-11 ins. Top of rock will be at El. 82.50 and the top of filter walls will be at El. 83.00, giving a 6-inch freeboard. Each filter will contain 4.725 acre-feet of filter rock for a total of 56.7 acre-feet. The top 36 inches of stone is specified to be 20-cycle rock and the remainder 10-cycle rock.

The pump discharge to each filter cluster will be delivered to a distribution well at the center of the cluster. The flow will be divided equally among the four filters by the use of splitting weirs. Stop plates are provided so that a filter may be temporarily removed from service for maintenance.

Filters will be arranged in pairs so that the discharge gullet will be continuous through two filters. The discharge from each group of four filters will be conveyed to the final tank serving that group.

Three final basins are being constructed, one serving each of the trickling filter groups. Final basins

are 205 feet in diameter, have a sidewall depth of 16 ft.-6 ins. and a sidewall water depth of 9 ft.-11 ins. In order to reduce weir loading, the basins will be equipped with triple weirs. The design basis of the basins at a flow rate of 25 mgd each is as follows:

| | |
|----------------|---------------------------|
| Detention Time | 2.45 hours |
| Overflow Rate | 693 gals./sq. ft./day |
| Weir Loading | 13,800 gals./lin. ft./day |

The final basin walls are set at El. 79.25 which will provide freeboard above the level of the Corps of Engineers' maximum design flood in the Arkansas River. The top of the new Arkansas River Levee is at El. 77.0 so that the top of the basins will be above the top of the levee. Final basin weirs will be set at El. 72.83.

A secondary sludge pumping station is provided adjacent to each final basin to transfer the sludge from the basins to the sludge conditioning facilities. Two separate two-speed sludge pumps will be provided for each final basin and the sludge will be removed at uniform rates of either 100 gpm or 260 gpm for each pump.

Sludge Conditioning and Digestion

Sludge conditioning facilities being provided consist of a chemical building, a rapid-mix chamber, and a combination flocculation and sedimentation basin. These units will be sized for a maximum flow rate of 1 mgd. The chemical building will house a lime feeder, a copperas feeder, and a chlorine feeder as well as storage space for chlorine cylinders. The chlorine will be used in treating the copperas to produce chlorinated copperas. The sludge

from the basin will be drawn off by either a plunger-type raw sludge pump or a "Scru-Peller" raw sludge pump, both of which will be operated by time clocks. These pumps will be located in the sludge-control house basement.

Three 100-foot diameter sludge digestion tanks with 31-foot sidewall depths are being constructed. The control house is situated between two of the digesters.

In order to reduce the dead space in the digesters, each digester will be provided with a high-rate sludge circulation system. Sludge will be circulated through this system at a rate of 700 gpm. (This will be in addition to the 300 gpm to be circulated through the sludge heaters.) The high-rate circulation system will have suction connections at seven points on the digester floor, and the net volume of the digester will be calculated above 30-degree slopes from these points. This will approximate the same effect as providing 7 smaller digesters in the same area. The suction and discharge headers for the circulation system will be installed in an annular tunnel constructed around each digester.

The digesters will be equipped with floating covers and digester heating will be by external heat exchangers. Gas recirculation equipment of the Pearth type will be provided on the floating covers. The sludge, supernatant, and gas piping in the digesters will be arranged so that the tanks may be operated either in series or parallel.

The sludge heaters, sludge gas control equipment, raw sludge pumps, sludge circulation pumps, and digester control piping will be housed in the sludge control building. This building will also contain

office space, a laboratory, and wash-room facilities.

Sludge drying beds having a total area of approximately 200,000 square feet will be provided. Since these beds will be excavated into a natural sand formation, they will not be provided with underdrains.

A water well will be constructed to provide a potable water supply for the plant. Treatment facilities as required to produce a water of satisfactory quality will be provided. A separate system utilizing plant effluent for yard irrigation and plant washing will be provided.

Settled Sewage Transmission Line

The settled sewage transmission line between the existing primary plant and the new plant will be approximately 17,000 feet in length, and will be constructed of 66-inch reinforced concrete pipe with rubber and steel joints. The line will be laid on a minimum grade of 0.08 percent and will have a capacity of approximately 61 mgd.

As the line will carry only settled sewage, access manholes will be spaced at maximum intervals of 2,000 feet. In order to prevent corrosion of the concrete pipe, the action of hydrogen sulfide gas will be controlled by keeping the pipe submerged at all times. This will be accomplished by throttling the line at its downstream terminus.

The line will cross the Arkansas River by means of an inverted siphon just after it leaves the existing plant site. The siphon will be made of 48-inch pipe to ensure suitable velocities at low flows.

New Primary Plant

The primary treatment portion of the new plant now under construc-



● CONSTRUCTION view shows trickling filter groups and final settling basins, with digesters and control house at right.

tion is designed for an average daily flow of 10 mgd and a maximum daily flow of 20 mgd. The main structures being constructed include a raw sewage pumping station, grit chambers, primary basin, and Parshall flume.

The sewage enters the pumping station through a two-pass screen chamber, one channel of which is equipped with a mechanically cleaned bar screen controlled by a time clock. The other pass will at present be a bypass channel and is equipped with a manually cleaned bar rack. Provisions will be made for the future installation of a mechanically cleaned screen in the bypass channel. The pump station is equipped with three horizontal non-clog pumping units with provision for a future unit. These pumping units take suction from a common wet well and discharge to the grit chamber at a 10 mgd rate for each pump. Of the installed pumps, two are single speed and one is multiple speed. These pumps will be controlled by a pneumatic type liquid level controller in such a manner that one pump will be on stand-by at all times, and a selector switch will be provided so that the sequence of pump operation can be changed on the single speed units.

A new two-pass grit chamber is under construction. One channel is equipped and the other will be a bypass channel arranged so that future equipment can be installed. Splitting weirs are provided at the head of each channel so that they may be operated in parallel in the future, and suture weirs are provided at the downstream ends of the channels to control flow velocities. For a single channel flow of 5 mgd the velocity will be 0.88 fps; for 10, 15 and 20 mgd the velocity will be 1.00 mgd; and for 30 mgd the velocity will be 1.30 mgd.

One circular primary settling tank 180 feet in diameter is being constructed. The tank has a sidewall water depth of 9 feet and a center

water depth of approximately 16 feet. The tank is provided with circular sludge and scum removal equipment. In order to reduce weir loadings, the basin is equipped with triple weirs.

A primary sludge pumping station is provided to transfer the sludge and scum from the primary basin to the digestion tanks. Separate pumps will be provided for sludge and scum, and the piping will

maximum anticipated high water without flooding out the primary basin weirs.

In addition to the construction at the new plant site, certain improvements are also being made at the existing primary plant. These include a new raw pumping unit to replace an existing unit, additional access roads around the plant property, a new Parshall flume including flow metering and transmitting

PRIMARY PLANT DESIGN BASES

| | 20 mgd (present maximum) | 30 mgd (future maximum) |
|-------------------------------------|--------------------------------|-------------------------------|
| Retention Time (Hours) | 2.6 | 1.73 |
| Overflow Rate (Gallons sq. ft. day) | 855 | 1,280 |
| Weir Loading (Gallons lin. ft. day) | 12,200 | 18,300 |

be so arranged that either pump can pump scum or sludge to the sludge conditioning facilities as well as to the digesters. The sludge pump is a centrifugal pump of the "Scrubber" type and the scum pump a plunger pump. The centrifugal sludge pump has a drive unit capable of providing a 3 to 1 variation in output speed. The sludge will be removed at a uniform rate of approximately 100 gpm to the sludge-digestion tanks.

A concrete Parshall flume capable of measuring flows from 0 to 60 mgd is under construction on the outlet of the primary basin. A transmitter is mounted on the structure which will activate an indicator-totalizer-recorder in the sludge control building and an indicator in the raw sewage pumping station. Upon leaving the Parshall flume the total settled sewage flow from this plant will be mixed with the flow from the existing primary plant and the mixed fluid will become the secondary plant influent.

The elevation of the primary treatment facilities will be such that gravity flow to the secondary treatment will be maintained during the

instruments, and prechlorination facilities for odor control at the existing raw sewage pumping station.

Construction Contracts

The work on the overall project is divided into four contracts. Dondlinger and Sons Construction Company, Inc., of Wichita was the successful bidder on Contract 1 in December 1957, and on Contract No. 4 in January 1959. These two contracts include all of the work on the project except the settled sewage transmission line between the new and existing plants, and the purchase of three settled sewage pumping units. Contract No. 2, covering the 66-inch transmission main, was awarded to Utilities Contractors, Inc., of Wichita in December 1957, and Contract No. 3, covering the purchase of the settled sewage pumping units, went to Fairbanks, Morse and Company at the same time. The total contract awards were as follows:

| | |
|----------------|----------------|
| Contract No. 1 | \$2,829,273.00 |
| Contract No. 2 | 839,452.93 |
| Contract No. 3 | 35,000.00 |
| Contract No. 4 | 1,853,858.00 |

Total Contract Awards \$5,557,583.93

Frank H. Backstrom is City Manager of Wichita and the City's Water Supply and Sewage Treatment Division is in the capable hands of Robert H. Hess who is the Director. Roger D. Lee is the Superintendent of the Sewage Treatment Division. Black & Veatch are the designing and supervising engineers, and R. F. McKinney is the resident engineer in charge for Black & Veatch. General Superintendent for Dondlinger is J. W. Leighty, Assistant Superintendent is Fred Bedigrew and the Contractor's field engineer is Roger Coad.

Suppliers of Major Items of Equipment and Materials

| | |
|---|---------------------------|
| Final, Primary and Chemical Basin Equipment | Process Engineers, Inc. |
| Rotary Distributors for Trickling Filters | Ralph B. Carter Co., Inc. |
| Digestion Tank Floating Covers, External Heat Exchangers, and Gas Recirculation Equipment | Pacific Flush Tank Co. |
| Mechanically Cleaned Bar Screen and Grit Removal Equipment | Link-Belt Co. |
| Raw Sewage Pumping Units | De Laval Pump Co. |
| Settled-Sewage Pumping Units | Fairbanks, Morse & Co. |
| Reinforced Concrete Pipe for Transmission Line & Plant Piping | Lock Joint Pipe Co. |

THE JOB OF THE TRAFFIC ENGINEER--- IT LASTS THE LIFETIME OF A ROAD

A. J. BASILE,
Engineer of Traffic Services,
State Highway Commission of Kansas

THE JOB of a traffic engineer in any state highway department traditionally has been one in which sincere thinking must be directed toward the welfare of the driver, the vehicle, the roadway and the pedestrian. He has not done the job to his satisfaction if any one of the four is slighted in his planning.

The driver's convenience and safety must be carefully considered. Directional signing, lighting and pavement markings must be intricately worked out, yet they must provide simple direction so the motor vehicle may be maneuvered easily over highways, down city streets and through interchanges.

The roadway must be striped and effectively signed and intersections

signalized to accommodate the traffic in an orderly manner. And it must be kept in mind, there will be pedestrians who have every right to trust they may cross safely at specified locations.

It would seem that, if all factors were worked out for the convenience and safety of the driver, problems would be solved for everyone concerned. It follows, also, if the vehicle can be maneuvered easily and safely, there should be no serious danger to the pedestrian. In fact, why should not all the pieces fall into place to make a pleasant picture if all factors in any one of the four categories mentioned above were carefully considered?

Such is not the case. All the facts together bring out one answer: Everyone and everything which will use the highway in any manner must be provided for. Individual

attention must be given to each phase of the transportation problem.

In the general scheme of things, administrators plan the route; and then right-of-way, legal, planning, design, construction and other department personnel have their well-defined assignments. The contractor, himself, has the big job of actual building. Finally all these reach the place where they may step back, look over the results and say with satisfaction "we did a good job."

This gratifying point in highway building is one which finds the traffic engineer still a long way away from the moment he may lay down his tools and say to himself, "well done."

His assignment, in fact, will last the lifetime of the roadway, with troubles great or small arising in direct relation to changes in traffic conditions. Most certainly a traffic

W-1035
24"x24"

W-201 RT. ORLT.
36"x36"

W-35
18"x18"

W-1015 RT. ORLT.
30"x30"

W-35
18"x18"

W-2 RT. ORLT.
24"x24"

W-1035
24"x24"

W-203 RT. ORLT.
36"x36"

W-35
18"x18"

W-4 RT. ORLT.
24"x24"

W-35
18"x18"

W-5 RT. ORLT.
24"x24"

NOTE: * SHOW THE MAXIMUM SAFE DRIVING SPEED WHICH HAS BEEN DETERMINED BY THE BALL BANK INDICATOR IN THE FIELD. THE MILES PER HOUR SHOWN SHALL BE TO THE NEAREST FIVE MILES.

| MAXIMUM SAFE DRIVING SPEED | IDENTIFICATION NO. | SIZE | ADVISORY SPEED SIGN | SYMBOL DESCRIPTION |
|----------------------------|--------------------|---------|---------------------|------------------------|
| 10 MPH TO 31 MPH | W-201 RT. ORLT. | 36"x36" | W-1035 | 90 DEG. TURN |
| 35 MPH TO 46 MPH | W-1015 RT. ORLT. | 30"x30" | W-35 | 90 DEG. CURVE |
| 50 MPH TO 65 MPH | W-2 RT. ORLT. | 24"x24" | W-35 | 135 DEG. CURVE |
| 10 MPH TO 31 MPH | W-203 RT. ORLT. | 36"x36" | W-1035 | 90 DEG. REVERSE TURN |
| 35 MPH TO 46 MPH | W-104 RT. ORLT. | 30"x30" | W-35 | 135 DEG. REVERSE CURVE |
| 50 MPH TO 65 MPH | W-4 RT. ORLT. | 24"x24" | W-35 | 135 DEG. REVERSE CURVE |
| 10 MPH TO 31 MPH | W-205 RT. ORLT. | 36"x36" | W-1035 | WINDING ROAD |
| 35 MPH TO 46 MPH | W-105 RT. ORLT. | 30"x30" | W-35 | WINDING ROAD |
| 50 MPH TO 65 MPH | W-5 RT. ORLT. | 24"x24" | W-35 | WINDING ROAD |

● INSTALLATION of new advisory speed and warning signs, inaugurated in Kansas in 1957, has reduced accident rate.

engineer may expect to be back on any one location to cope with new conditions year after year. He does the best he can, and usually in a highly satisfactory manner, while actual construction progresses. After the road building is completed, he stays on to make sure lighting, signing and marking keep pace with demands year after year.

All this is not to say the traffic engineer is complaining. He learned to expect the unexpected long ago; and in each highway department throughout the nation he faces each new assignment for what it is. And almost invariably it is a challenge.

The biggest challenge of recent years came with the passage of the 1956 Federal Aid Highway Act which made possible the beginning of construction on the National System of Interstate and Defense Highways. Along with the Interstate have come entirely new concepts in traffic control methods and devices.

Impact of The Interstate System

Kansas' 800 miles of Interstate construction is going through and around the metropolitan areas of Kansas City, Wichita and Topeka. It passes through hilly and flat country; it touches areas of dense population; and sweeps across blue-stem pastures and vast wheatlands where population thins out to virtually nothing.

The work calls for thorough study of geometrics of highway construction, accident experience and analysis, lighting and development of projects and their maintenance, signalization, channelization, designing and study of present and future traffic volumes.

Through years of experience with primary state and federal routes, traffic engineers throughout the United States have developed techniques which are tried and proven. Little difficulty is being encountered in finding answers from statistical data relating to the problems of the driver, the vehicle, the roadway and the pedestrian. Studies of the nature and volume of traffic, its origin and destination, facts affecting speed, safety and convenience—experience in all these is paying off in the Interstate traffic control program.

A new work load, or rather two new work loads have come into the traffic engineer's office in Kansas, as in many other states. These are signing and lighting on the Interstate system.

In the case of urban area lighting, the Kansas Highway Commission is paying for the installation, operation

and maintenance lighting of the urban expressway sections of the Interstate system in a manner similar to that required for any lighting on the rural freeways.

In signing, a great many overhead structures seem to be in prospect. Kansas has designed overhead installations and these are being analyzed at the present time. No final word as to whether they will prove to be of an aluminum or steel specification is available to date.

Actually the impact of planning for the Interstate system has substantially enhanced the level of traffic engineering in Kansas. Greater dependence is placed on traffic engineers for the review of interchange and roadway geometrics related to road-user safety and comfort and for the prevention of accidents at the high speed, high volume operation to be expected.

Lighting and signing of the Interstate System is governed closely by standards of construction established by the Bureau of Public Roads. In the case of lighting projects, it was necessary to develop preliminary design criteria which received

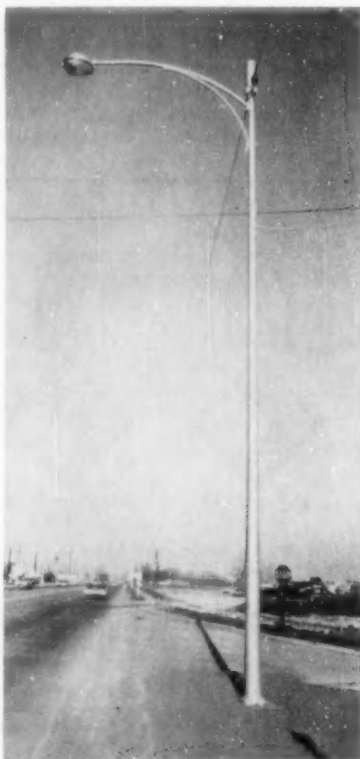
tentative approval of the Bureau for application in Kansas. For programming purposes, it was determined that major interchanges (complex) would be lighted on Interstate urban sections and extensions into the suburban areas of large metropolitan areas. The level of maintained lighting would be approximately 0.8 foot-candle. Minor interchanges would be lighted only at entrance and exit terminal points and at grade intersections with cross highways as in a diamond interchange. Lighting system standardization calls for the use of 400-watt mercury-vapor lighting units mounted on ornamental steel poles. Continuous roadway lighting is not generally planned except on long viaducts or major ramp structures of interchanges within cities.

All of this was superimposed upon a lighting program for federal and state highways where justified by traffic volumes, congestion and accident experience. Much of the latter program is developed in cooperation with cities, counties and townships. Many times the lighting construction is contracted by the state with local government jurisdictions accepting the responsibility for operation, maintenance and energizing the systems. Lighting of rural highway junctions usually is the full responsibility of the state.

Lighting of highway connecting link streets in cities is a local responsibility, but the Traffic and Safety Department cooperates regularly with the cities in the planning of the systems. Lighting of the urban sections of the Interstate system will be the complete responsibility of the state and federal governments with maintenance, energy and operation costs to be paid by the state.

Signing

Signing for the Interstate system is proceeding rapidly in Kansas. It is handled somewhat differently than the lighting program. Fixed standards are available for use of all states in the application of guide, directional and warning signs for the freeway system. At the present time, under the immediate supervision of J. Francis Barclay, Highway Marking Engineer, Kansas is preparing construction plans for erection of signs on two major sections of the National System totaling approximately 55 miles. These will be erected prior to January 1, 1960. Another section which may be completed and signed to the Interstate standards will be a 23-mile length of I-70 in Trego County.



● LIGHTING projects for federal and state highways and for the Interstate system are important responsibilities of the Traffic and Safety Department. This shows new lighting between Fort Riley and Kansas City.



● **OLDER NARROW** roads and bridges invited the fixed-object and head-on types of collisions. A major program of pavement and structural widening is in progress.



● **THIS NEW BRIDGE** and wider roadbed is located parallel to the road pictured at the top of the page. It is typical of modern state and Federal routes in Kansas.

Some of the first problems which had to be determined, and for which design specifications were completed, concerned the type of overhead sign structures required. These must carry overhead directional guide signs and proper sign lighting. Another was the development of the actual signs themselves, both for ground and overhead application. It is the hope of engineers in Kansas that the Highway Commission may continue to fabricate its own signs as it does for the regular primary system. The department would furnish signs to the erection contractor for installation along with overhead structures, ground supports and bases. Kansas officials believe that much better uniformity of

signing and future maintenance is secured in fabrication of the actual signs by state forces.

Interstate Route 35 from Ottawa northeasterly to Kansas City is one section of the Interstate that should be signed before the end of this year. Resigning to Interstate standards will be done on an urban extension of Interstate route 70 in Kansas City. Kansas has several other sections of the Interstate constructed; however, for the immediate future, they will be operated with temporary signing. Since the Kansas Turnpike is under the direction of an authority separate from the State Highway Commission, it is necessary for the Commission regularly to cooperate in the develop-

ment of additional signs for sections of the Turnpike which have been approved as a part of the Interstate System.

Traffic Engineering Organization

Since this added load is superimposed on an established program of traffic engineering for the rural primary system and the urban extensions in cities, it has been necessary to expand the organizational staff for Kansas traffic engineering needs. The Traffic and Safety Department is in a transition stage at the present time.

The Traffic and Safety Department has the responsibility for traffic engineering on the rural system and, to a major extent, cooperatively with local officials on urban connecting links of the state highway system. The normal functions performed by this department involve the acquisition and compilation of traffic data related to traffic volumes, vehicle speeds and zoning, congestion, speed and delay, city traffic and regulations, signing, rural highway route signing, intersectional control, both urban and rural, hazardous location studies, junction signing, traffic line markings, redesign and reconstruction of existing intersections and design review of new interchange designs on the rural system and on urban lengths in cities.

This department is charged with the responsibility of determining warrants for traffic signal installation and speed study data for the establishment of reasonable speed limits as well as route and warning signing of the connecting links. The application of traffic signals and speed limits on the urban sections require approval of the State Highway Commission. When these are determined advisable, this department prepares traffic signal installation and speed study posting plans for use by the cities in completing the installation.

The department's signing and marking section prepares all plans for signing of new intersections and junctions on the state system, and for resigning of intersections and curve warnings, the delineation of curves and revision of established route signing as required. This section has developed the standards of sign application and specifications for the manufacture of signs used on the state system. The fabrication and completion of all signs is directly supervised by the department. Sign plants are located at the State Penitentiary, Lansing, and a headquarters sign finishing shop in To-

peka. The department directs and supervises the application of all signing needs through the established maintenance forces in the geographical divisions of the Commission, in cooperation with the Maintenance Department.

In order to carry this responsibility for traffic engineering, it has



● **SUNBURST** sign used at grade crossings has added effectiveness.

been necessary over the years to train and develop traffic engineers, of which Kansas has five in the Traffic and Safety Department.

Training and developing of sub-professional help for this work is given much attention. Engineer development has been and is a continuing process in the state, since the availability of qualified traffic engineers with experience in both urban and rural highway work has been inadequate. Another traffic engineer, a Yale Bureau of Highway Traffic School graduate, with considerable experience in the department, has been transferred to a new urban highway department as Engineer of Plans and Traffic. Several other traffic engineers work in the State Highway Planning Department.

Special Traffic Problems and Procedures

The development of new curve and turn signing standards which increased the size of the advisory speed signs and placed them above the turn and curve signs was inaugurated in July, 1957, and this program advanced rapidly so that within the first year of operation, with the new curve and turn sign assemblies, a marked reduction in accidents was noted. About the same time, an edge marking program was developed for specific test sections where the surface widths were adequate, but narrow roadbeds existed. The first one hundred miles of application were determined by the

needs of the section, both as regards to the typical cross section, and as related to traffic volumes and high accident rates. Approximately 203 miles of edge marking has been placed, using a solid 4-in. edge line, white, and the first year of operation has indicated an appreciable reduction in the accident and fatality rates for these sections.

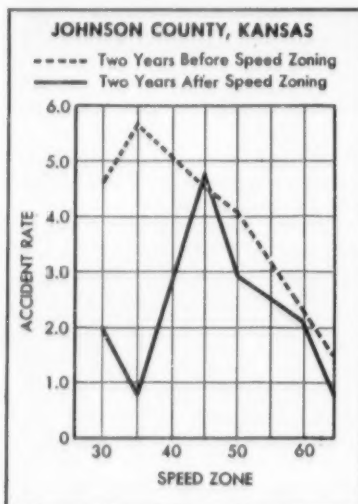
The year 1955 proved to be a serious accident and fatality rate year on the Kansas streets and highways and one of the problem locations that was determined from annual analyses of the various types of accidents in the state was railway-highway grade crossings. Aside from the regular highway programming of signalization of railroad crossings, the Traffic and Safety Department developed a Sunburst sign which was designed with diagonal markings on a circular shape to surround the uniform W-32 Railroad Advance Warning sign. These were applied along with the W-32 signs on all crossings of a serious nature not yet programmed for railroad signalization. The results to date of the use of this sign are promising.

Another major program of the State Highway Commission is the widening of narrow structures, pavements and roadbeds on the state and federal highways. The Traffic and Safety Department has contributed regularly to the program through the use of accident facts for substandard locations. The program is proving itself through the reduction of fixed-object and head-on collisions and is one of the primary reasons for sustained re-

ductions in fatalities in the state highway system which was first noted during the latter part of 1956 and in 1957 when a reduction of about one hundred fatalities was attained for the year. Another important program, developed by Claud R. McCammett, Director of Safety, has been the Military Traffic Safety Conferences, conducted semi-annually. The objective is military accident reduction. One major result has been the modernization of traffic signing on several large military bases in Kansas, such as the Fort Riley Reservation and Forbes Air Force Base. Through cooperation with safety officers and provost marshals, traffic signing on internal roads on the bases has been brought up to higher standards conforming to the requirements of the Manual on Uniform Traffic Control Devices.

For many years, until May, 1957, the State of Kansas did not have a maximum statewide speed limit and operated under the old "reasonable and prudent speed law," for rural highway, rural county and local road enforcement. When accidents and fatalities sharply increased during 1955, the Traffic and Safety Department, with the cooperation of the Governor's office and the State Highway Commission, started a program of maximum speed limits for day and night use on many rural substandard highway sections where the accident rates were excessive. As a part of this program, all state and federal highways in two major urban counties were zoned. This led to the establishment of approximately 80 miles of additional speed zones making a total of 99 miles of speed zones on the state and federal highways in Johnson County (Kansas City Metropolitan Area). Objective of the program was a complete speed control plan which received consistent cooperation of the State Highway Patrol and the sheriff's departments of the counties.

An example of some of the lighting projects prepared and developed by the Traffic and Safety Department as a part of the regular program, was the high volume high accident rate intersection of US-24, 40 and US-59 north of Lawrence. Also in cooperation with the Mission Township Board, incandescent lighting was installed for approximately three miles on US-69 through the Overland Park area as part of a widening and improvement project. The first lighting system was designed, constructed and maintained by the state. The second was prepared by the Traffic and Safety De-



● **RELATION** of accident rates to speed limits, before and after the establishment of speed limit zones on all State and Federal highways.

partment, with construction and maintenance costs paid by the Mission Township Board. Examples of cooperation between the state and counties are lighting systems on US-81 Highway north and south of Wichita, covering several miles. Plans and recommendations were made by the Traffic and Safety Department and the construction, costs, maintenance and operation of the systems were accepted by the Board of County Commissioners of Sedgwick County. Our first Interstate lighting project was the plan development and use of 400-watt mercury-vapor systems for the Muncie Expressway on Interstate 70 at the east end of the Kansas Turnpike through Kansas City. To date, it is the only Interstate lighting project completed and placed in operation. The Traffic and Safety Department is in the process of preparing project plans for several other systems on Interstate construction, and is supervising lighting plan preparations by consultants for other sections of the Interstate routes.

K-18 for many years carried high volumes of traffic, including a high percentage of military traffic to and from Fort Riley and Junction City. The traffic using an old 2-lane section averaged 14,000 vehicles a day. When this highway was reconstructed to a 4-lane divided facility, lighting was immediately considered to help control a high nighttime rate of accidents. The system has been completed and is in operation with a definite improvement shown.

An example of accident improvement through the use of highway lighting of a rural highway junction is shown by the accident experience

comparison for the Junction of US-40 and US-77 southwest of Junction City in Geary County.

While this work proceeds consistently, the regular functions of the Traffic and Safety Department in handling problems of traffic control and regulation, speed zoning and signing, and hazardous location surveys have been conducted. City-state cooperation on connecting links is conducted at the request of local officials. It has always been the objective of the department to assist cities and to conduct citywide traffic surveys. These are traffic regulation and implementation surveys which assist cities with immediate corrective procedures on signalization, signing, relief of congestion, control of parking, regulatory procedures and reduction of traffic accidents. At the present time, surveys are being conducted in the Cities of Liberal and Derby, two of the fastest-growing cities in Kansas.

Signalization

The state seldom constructs traffic signal installations directly, other than flashing beacon installations where required at rural highway junctions. However, at least four complete traffic signal and lighting systems have been built by the state during the last year at high volume, high accident intersections in suburban areas where there is no local government closely associated with the problem. One is at US-50 and Roeland Drive near Mission in Northeast Johnson County. As previously mentioned, signalization problems are studied cooperatively with cities and counties. Approximately 70 traffic signal warrant

studies are completed yearly by the department. Of these, some 20 to 30 each year are found to justify signal installation. The signal construction plans are completed by the state and construction and operation is performed by cities and counties. Many flashing beacon installations are handled in a similar manner.

Flashing beacon installations on the rural highway system (some 10,000 primary miles) are usually applied on a warrant basis at high accident rate junctions. These installations are paid for and maintained by the State. The use of the over-and-under type beacon signal arrangement has proved effective at several of our high rate accident junctions such as at the Junction of US-24 and K-99 at the north edge of Wamego.

Future development of the traffic engineering program for this state will be, wherever possible, to eliminate the need for signalization of high volume intersections by construction of interchanges where entering traffic volume justifies the expenditure of funds for this purpose. Highway lighting is another roadway feature which is important to the transportation system in order to make travel comfortable and safe for the public whether in daytime or nighttime. In many locations, capacities must be maintained to their maximum at nighttime as well as in the daytime. The development of traffic engineering personnel and functions in the Traffic and Safety Department of the State of Kansas has as its goals and objectives a safe, efficient and comfortable transportation system.

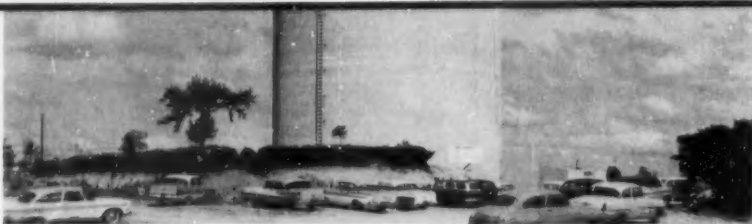
| HIGHWAY | | LENGTH | TWO YEAR ACCIDENT EXPERIENCE | | | | | | | | | | | | TWO YEAR FATALITY EXPERIENCE | | | | | | ACCIDENT EXPERIENCE | | | |
|---------|-------|--------|------------------------------|-----------|------------------|------------------|--------------------------|----------|------------------|------------------|--------------------------|----------|-----------------|-------------------|------------------------------|-----------------|-------------------|--------------|-------------------|------------|---------------------|------------|--|--|
| | | | BEFORE | | | | AFTER | | | | BEFORE | | | | AFTER | | CHANGE | | PERCENT OF CHANGE | | | | | |
| | | | BEFORE ADT | AFTER ADT | NO. OF ACCIDENTS | INJURY ACCIDENTS | NO. OF PERSONAL INJURIES | RATE MVM | NO. OF ACCIDENTS | INJURY ACCIDENTS | NO. OF PERSONAL INJURIES | RATE MVM | FATAL ACCIDENTS | NO. OF FATALITIES | RATE 100 MVM | FATAL ACCIDENTS | NO. OF FATALITIES | RATE 100 MVM | ACCIDENTS | FATALITIES | ACCIDENTS | FATALITIES | | |
| K-10 | 21.65 | 5020 | 4427 | 202 | 83 | 101 | 2.55 | 143 | 38 | 63 | 2.04 | 3 | 3 | 3.78 | 3 | 3 | 4.23 | -59 | NONE | -20% | +12% | | | |
| US-50 | 27.57 | 4964 | 3388 | 284 | 88 | 146 | 2.84 | 237 | 71 | 111 | 2.16 | 12 | 21 | 19.4 | 5 | 5 | 4.61 | -47 | -13 | -22.9% | -76.2% | | | |
| US-69 | 15.74 | 3245 | 3148 | 140 | 71 | 123 | 3.75 | 142 | 47 | 80 | 3.93 | 3 | 3 | 8.05 | 3 | 3 | 6.30 | +2 | NONE | +4.6% | +3.0% | | | |
| K-150 | 9.88 | NONE | 2790 | NOT | ON STATE SYSTEM | | | 27 | 6 | 6 | 1.34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| US-169 | 9.32 | 2170 | 3090 | 47 | 21 | 32 | 3.18 | 39 | 11 | 16 | 1.86 | 0 | 0 | 0 | 0 | 0 | 0 | -8 | 0 | -41.5% | 0 | | | |
| TOTAL | 84.16 | 3850 | 3765 | 673 | 243 | 402 | 3.32 | 588 | 171 | 284 | 2.54 | 18 | 24 | 12.9 | 11 | 11 | 7.44 | -65 | -13 | -21% | -42.3% | | | |

● TABULATION shows results of an accident experience study based on a two-year comparison of county-wide speed zones in Johnson County, Kansas. The accident rate was reduced from

3.22 to 2.54 accidents per million vehicle miles; fatalities dropped from 12.90 to 7.44 per 100 million vehicle miles. The chart on the opposite page shows results for each speed zone.

PRESTRESSED CONCRETE STANDPIPE

● WITH the slip form method of construction, forms are carried upward, being supported by the quick-hardening cement wall.



A NEW 2.95-million gallon prestressed concrete standpipe has just been completed by Sayreville, N. J., as part of a \$1,200,000 water expansion program. The cylindrical tank is the largest of its type yet constructed and is 122 ft. high by 65 ft. inside diameter; the wall is 12 ins. thick. The tank was built by the slip form method and for the first time forms for the dome were carried up with the wall forms.

The tank was prestressed by wrapping it with wire applied under tension, thus providing a low-cost structure that readily withstands the outward forces exerted by tank contents. The master plan for the water expansion program was developed by Charles J. Kupper, Consulting Engineer, New Market, N. J., and the standpipe was designed and constructed by The Preload Co., Inc.

Sayreville has in the past purchased its water from the near-by

town of Perth Amboy, N. J. However, with the rise in population of both communities, the Perth Amboy supply was not sufficient for both towns and, in addition, the increase in Sayreville population justifies the installation of its own water supply. Water will be obtained from wells, passed through an aeration and filtration plant which is already installed, and stored in the standpipe. The master plan includes two additional large standpipes to be constructed in the future in other sections of the Borough.

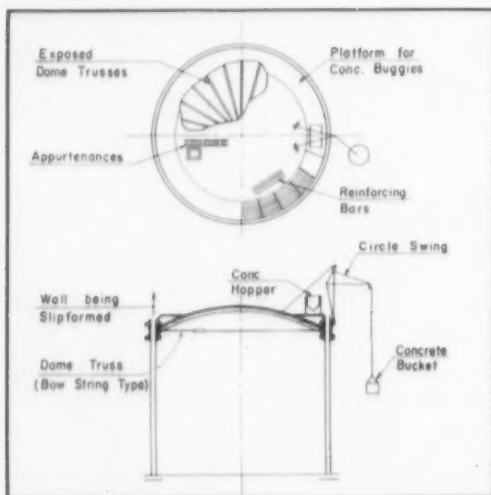
Foundation and Base

The foundation of the standpipe comprises a reinforced concrete footing ring 2 ft. thick by 8 ft. wide, and a 1 ft. thick foundation slab inside the ring, flush with the top of the footing. A continuous plastic water-stop is cast in the footing and extends horizontally into the foun-

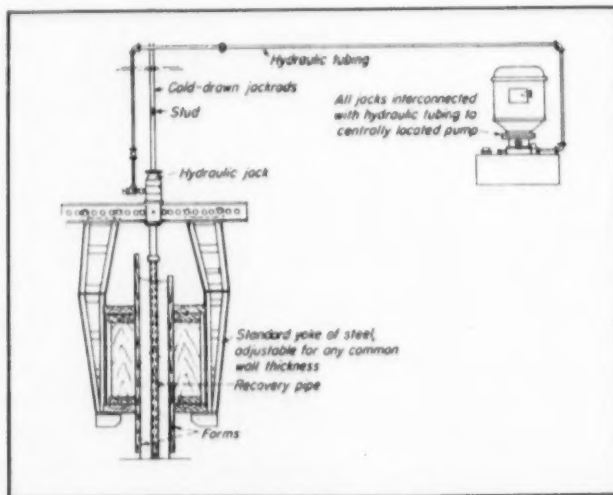
dation slab. A second water stop extends vertically upward into the standpipe wall.

Two sections of 12 in. cast-iron pipe were installed before placing the footing and slab. These sections are enclosed in lean concrete and extended horizontally under the footing and vertically up through the floor slab.

The wall of the standpipe is supported on rubber pads, one on either side of the water-stop. This method of support was developed by Preload. With it, when prestressing wire is wrapped around the circumference of the tank, the base of the wall is compressed uniformly, and is not subjected to non-uniform stresses which result when the wall rests directly on the foundation. Under such conditions, even when lubrication is applied between wall and foundation, differences in friction from one location to another



● FORM for the dome was carried up with the wall and served as a work and storage platform.



● SLIP forms were suspended from yokes which straddled the wall and were raised hydraulically as construction proceeded.

result in non-uniform stresses which can cause cracks and leaks.

The pads also avoid large bending moments in the wall since the base of the wall is not rigidly fixed. The rubber pads begin to deform with the first application of the prestressing wire and the deformation gradually increases as prestressing progresses. Vertical stresses are reduced to approximately 30 percent of those which develop with the lubricated sliding base. Thus, the thickness of the wall can be less than with a sliding base and is usually determined by circumferential prestressing rather than by the vertical moments.

Wall and Dome Construction

The wall was constructed by the slip-form method, 45 in. high wall forms being hydraulically raised approximately 1 inch every 4 minutes as newly placed concrete hardened. Placing of concrete was continuous and the resulting wall is thus a continuous monolithic structure with no cracks or joints. It took 117 hrs. to complete the placing of the concrete wall, two 12-hour shifts being employed.

The slip forms were suspended from yokes which straddled the wall. Legs of the yokes extended downward along the outside of the forms and supported them on shoes which fitted under wales of the forms. The yokes have hydraulic jacks built into their midsections and elevate the forms by climbing jack-rods cast into the wall as it is constructed.

Reinforcing for the wall consists of $\frac{1}{2}$ in. vertical bars placed toward inner and outer wall surfaces at 12 in. intervals, and horizontal bars tied at 12 in. intervals to the vertical bars. These bars were installed as the forms were raised. Vertical reinforcing bars were held in place by jigs on the forms.

Ready mixed concrete was trucked to the site, emptied into a 1-cu. yd. bucket and hoisted to a hopper on the working platform. Buggies carried the concrete to the forms and it was then worked into place and consolidated by vibrators. Inner and outer surfaces of the wall were hand finished from scaffolds hung from the forms.

When the wall was completed, $\frac{5}{8}$ in. bars 18 ins. long, pointed at one end, were driven through the forms and into the concrete just below the upper wales to take the load off the forms. Yokes, hydraulic oil lines and the pump were then dismantled and the platform cleared.

A $\frac{5}{8}$ in. thick rubber pad was cemented to the top of the tank wall, separating it from the dome ring and again allowing wall and dome to deform independently.

As previously mentioned, the form for the dome was carried up with the wall, the first time this construction method was employed. Construction at ground level is of course simpler, safer and less expensive than at the summit. Also, the dome form served as a work and storage platform during wall construction. Sheathing for the form was supported on 24 arched trusses radiating outward from the center of the structure to the slip forms. Twenty of the trusses were of the bow string type with tie rods at the base whereas four were regular trusses of wood strut construction. The four wood strut trusses were arranged to form four 90° quadrants and five bow-string trusses were equi-spaced within each quadrant. The tie rods of the bow-string trusses terminated at holes in a 36 in. diameter steel plate at the center of the structure. The arches of these trusses terminated at the center at wood hypotenuses of the 90° angles made by the four main trusses. The bow strings were bolted

to the arches at the slip form ends. The trusses rested on the wales of the wall forms, the dome sheathing being sufficient to keep them erect. The trusses were prefabricated by Roof Structures, Inc., Farmingdale, L. I., and were shipped to the site for assembly.

The trusses were sheathed with 1 x 6 lumber, surfaced on four sides. A temporary horizontal work platform was provided around the edge of the dome form for use during wall construction. Dome reinforcing consists of 4 x 4 10/10 wire mesh and #3 reinforcing rods. The dome tapers in thickness from 4¾ ins. at the outer diameter to 2½ ins. at the center.

Prestressing

After the tank wall and dome had been concreted, they were prestressed by winding with high tensile wire drawn to a diameter of 0.208 in. from the original diameter of 0.236 in. The wall was prestressed to offset the pressure of tank contents and the dome is prestressed to withstand lateral dead and live loads of the dome itself. In prestressing the dome, wire is wrapped around the edge. The wire imparted an initial force of 326 kips per vertical foot at the base of the wall, decreasing gradually to a force of 30.4 kips per foot at the top. Prestressing force on the dome was 96 kips.

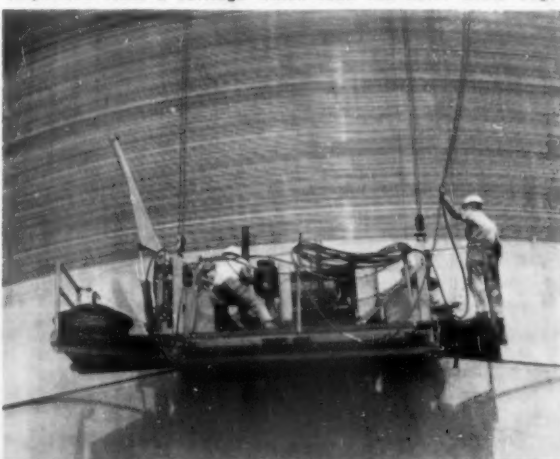
About an inch of pneumatic mortar was applied over the exterior of the tank and dome edge to bond the wire and to protect it from the weather.

The Preload wire-winding machine was suspended down the side of the tank wall from a carriage which rode the outer edge of the dome to apply the circumferential prestressing wire. The carriage was anchored to the center of the dome by radial cables and the entire mechanism was self propelled.

● FORMING of the dome on the ground was simpler and safer. The sheathing is supported on 24 arched trusses.



● WIRE winding machine which prestressed the wall was suspended from a carriage which rode the outer dome edge.



Providing Sewage Disposal for a METROPOLITAN AREA

HOWARD K. SCHONE,
Director,
Department of Public Works,
Oakland County, Michigan

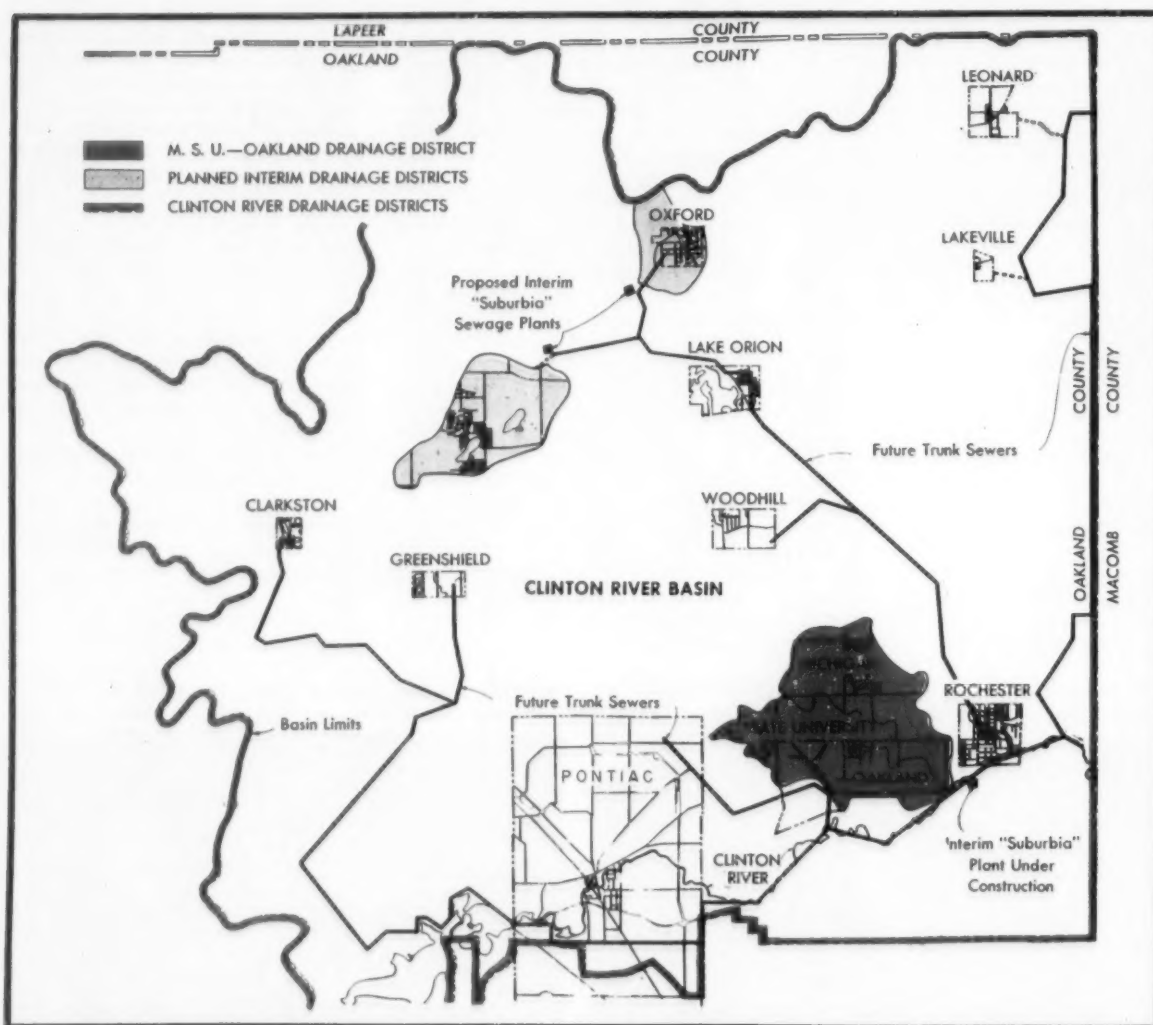
AS RECENTLY as last year, Oakland County, Michigan, faced serious difficulties in terms of sewage disposal. With a 42 percent population increase in the last nine years and an expected 66 percent increase by 1970, we were compounding our problem perhaps even a little faster than most outlying metropolitan areas.

The Clinton River Basin in our county has an area of about 220 square miles. In it lie two cities, seven villages and 12 townships—all directly in the path of the increasing population trend. As part of the Detroit Metropolitan Region (and the second largest of Michigan's counties) we knew we were destined for a tremendous growth in new homes, commercial establishments and, eventually, industry.

We welcome these, of course, but they bring with them utility problems which must be faced. And, as

with most other communities, we were not prepared for such growth. Most of our homes were served at that time by septic tanks. Over-all, our soil conditions could have accommodated only small and scattered additional subdivisions.

Actually, our County and local governments had been extremely successful in providing for the needs of our population, despite its rapid increase, except in the matter of sewage disposal and water supply. Of these two problems, sewage disposal was the more critical.



● GENERAL PLAN for the Clinton River Basin. A future central plant will be located downstream on the Clinton River.

The usual practice, under such circumstances, is to build new sewerage facilities based on financing ability, rather than on ultimate need. Often, as soon as these facilities are completed, they are being used to capacity. And, as greater financing ability develops, the facilities must be enlarged or replaced at substantial cost to taxpayers.

Recognizing that the only sound and economical solution to the prob-

lem lay in planning on an area basis, our municipalities and townships petitioned the County Board of Supervisors to develop a master plan for sewers and sewage treatment facilities for the Clinton River Basin. The Board, in turn, established the Clinton River Sewage Disposal System and placed it under the administration of the County Department of Public Works.

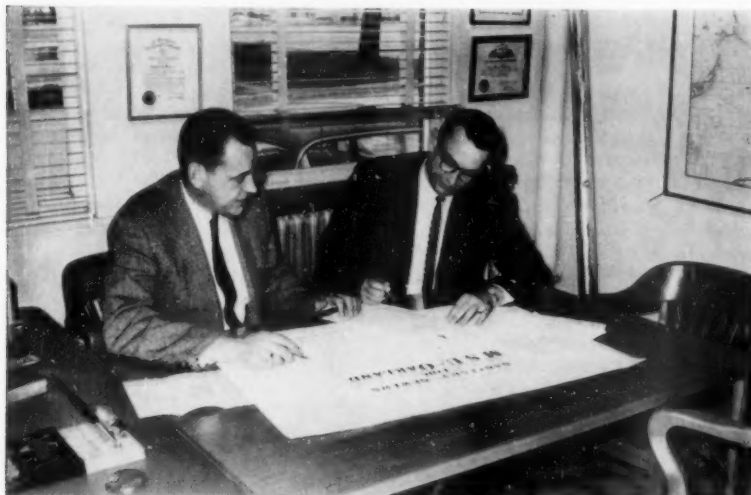
The Department is preparing con-

struction plans for the project with the aid of a "planning advance" from the Federal Housing & Home Finance Agency. This loan, totaling \$399,600, is one of the largest granted so far by that Agency.

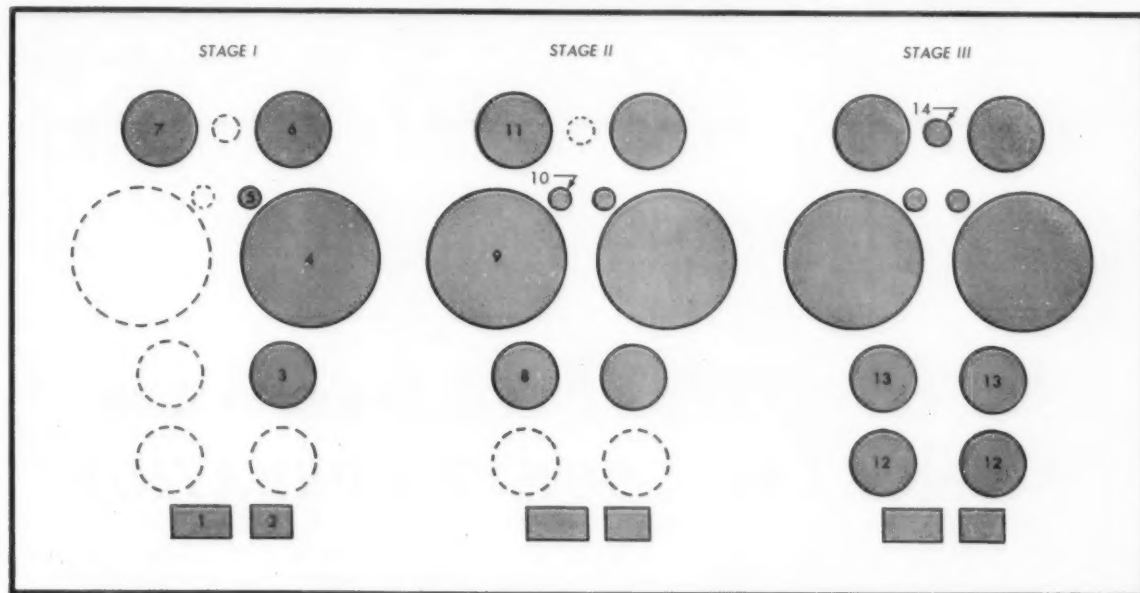
From an engineering viewpoint, the plan involves construction of interceptor sewers to transport all sewage to a central treatment plant located on the lower portion of the Clinton River. The down-river (southerly) section was found to be already near the danger point, requiring immediate relief. The interceptors have to be planned in sizes sufficient to accommodate both present and future populations of the upriver areas as well. In addition, enough land has to be acquired for the central plant site to permit the expansion we know must come.

The sewage treatment plant itself is a problem. First of all, the plant must be efficient and dependable. Second, it must be almost infinitely expandable. Third, it should be simple enough for relatively unskilled personnel to operate. Other essentials were low maintenance cost and freedom from nuisance.

Fortunately, the problem did not turn out to be insoluble. We learned of the "Suburbia" type of sewage treatment plant which consisted of a combination of standardized components according to individualized plans prepared by consulting sani-



● PLANS for the new sewage treatment facilities at M.S.U.-Oakland are reviewed by the author (l.) and R. P. Allen, Asst. Corporation Counsel for Oakland County.



1—Wet Well and Lift Station; 2—Control House; 3—Imhoff Tank; 4—Trickling Filter; 5—Recirculation Pump Well; 6—Final Clarifier; 7—Standby Final Clarifier

8—Imhoff Tank; 9—Trickling Filter; 10—Recirculation Pump Well; 11—Standby Final Clarifier in full use

12—Mechanical Primary Clarifiers; 13—Imhoff Tanks converted to Digesters; 14—Transfer Pump Well

● GROWTH PATTERN of this typical plant matches population expansion. The additions for each stage are planned in advance.

tary engineers for our engineering department.

Financial Factors

We had a strong desire to do the job right and felt that the burden of cost should be assumed by the people of the area. Yet, it was apparent that a bond issue could not be sold at a rate of interest which would make the project financially sound. And then the most complicating factor of all appeared on the horizon; but, as things turned out, it was the catalyst for our entire situation.

Michigan State University at East Lansing decided on Oakland County as the site for a branch within the Clinton River Basin. We were delighted and anxious to assist in any way possible. University officials were invited to bring their problems to us for consultation and one of the first (not surprisingly) was the problem of sewage disposal for the University branch and the new community which would surround it.

The State agreed to approve the University's Oakland County location on condition that it integrate with the County master plan of sewers and sewage treatment facilities. This was obviously a good idea, and through discussion it was decided to make the University site a pilot model for the entire Clinton River Basin project.

The Time Element

It was already February, 1959. The University, to accommodate eventually 20,000 students, its campus and entire physical plant would have to be ready for the fall semester. In addition, there must be homes built for University staff and service personnel, a shopping center, and the other services so vital to a new community. Sewers and sewage treatment facilities had to be in ex-

istence before this construction could begin.

The time element did not permit setting up a special assessment district or selling bonds. Oakland County, itself, did not have the immediate financial resources to put in sewerage facilities for the University and its immediately contemplated 700-home community. But the job had to be done; here is how we went about doing it.

The three interested groups—the University, County officials and the developers who will actually build the new campus community—met in my office to review the capabilities of the Suburbia type of sewage treatment plant with representatives of the manufacturer, Municipal Service Company of Kansas City.

Out of this meeting we evolved a workable plan, built around a single plant which will provide immediate sewerage facilities for the 3,000-student University branch and for the 700 homes in its community. Even more important, this plan represents the first integrated step toward our Clinton River Sewage Disposal System.

The three interested groups will combine to construct Phase One which includes the sewage treatment plant, the necessary collection system and intercepting sewers of size and location calculated to fit into the County master plan. The comparatively modest cost of the plant made it possible for us to obtain private financial backing.

The developers will advance their portion of the necessary funds to the County; under the terms of their contract, they will receive an eventual refund, except for sewer and plant connection charges. We plan to make a "use charge" for the time being; eventually, when the campus community is well-established, a

larger plant can be supported by tax revenue.

Construction has begun. The State Board of Health has approved our plans and our sewage treatment plant can be erected in 90 days or less, so that completion and hook-up with our new sewer system can occur almost simultaneously.

The main collecting line and the interceptor sewers run along the Clinton River. Eventually, these will tie into a major sewage treatment plant which will be built at some time in the future when we can afford to spend the estimated 5 million dollars or more for its construction.

Because the capacity of our plant can be enlarged by adding new units and converting to mechanical treatment, construction of the central plant may well be some few years away. But even at that future time, our present plant need not be abandoned. We can dismantle it and move it farther upstream to a new trouble spot. This can be done any number of times, with virtually complete re-use of components.

This is the story of our solution to an "insoluble" problem of national scope—one which will eventually face nearly all public works officials. In most metropolitan areas large tracts of suburban land are underdeveloped. If too few people live there, authorities cannot issue the bonds needed to build adequate sewerage facilities; yet, to attract more tax-paying inhabitants, adequate sanitary facilities must first exist.

We in Oakland County were fortunate in three respects: The problem was thrust upon us early enough; we had learned the strength of co-operative effort; and we found that a good sewage treatment plant could also be sensibly priced.

Liability Insurance **is a MUST for COUNTY OPERATION**

PAT THOMSON,
Douglas County Engineer,
Waterville, Washington

IN THE course of a short period of time, we had three accidents occur. A careless truck driver, in backfilling behind a constructed re-

taining wall, drove across a private concrete driveway, cracking off a triangular corner. Three miles away, a broken ditchline washed assorted debris and soils onto a lawn and into a utility room of a home. On a street repair project, a trench excavation gave away, carrying with it an adjacent ornamental rock wall

and three of the owner's prize arbor vitae.

Under ordinary circumstances, the report of three such major calamities within the space of twenty-four hours would have been quite upsetting, but now I lift the phone and call Tom Cain, General Insurance of America adjuster. In a few



● **BOUNDARY** lines in suburban areas must be carefully delineated so that street reconstruction does not encroach on private property. In case of accidental damage the insurance company handles all negotiations under the blanket liability policy.

moments of discussion I give him all the details, transferring my problems to him.

Several years ago, upon first assuming my duties as engineer of Douglas County, I checked my allotted budgetary funds. Then, having had unfortunate experiences in other locations, I checked the insurance coverage. It was found that the entire insurance program was spread among nine different companies.

Most counties have recognized the need of providing some insurance against injuries or damages that may be possibly caused by their various construction and maintenance operations. And this is particularly true in those counties having large areas of rapidly and highly developed suburban advancement. Most of the states have financial responsibility, guaranteed safety or safety responsibility laws that clearly outline the financial responsibility of a road department under their types of operation. Each administrator should be fully aware of how these laws affect the operation of his department. That is, what requirements do these laws demand that your organization comply with to be within the safety scope of your operations?

The importance of adequate protection through insurance is more than emphasized by special laws in most states restricting the rights of governmental units under certain operating conditions. For instance, in one suburban area, we had a group of teenagers who were tearing down road signs and dumping them into the Columbia River just for the "kicks" of it. They got from 50 to 60 signs a night for about two weeks until our sheriff's department finally nabbed them. During this period of missing signs, a truck cut an intersection, smashing a car and driver into oblivion. State law de-

mands our maintenance of stop signs, once established by resolution, regardless of conditions. Result—a terrific lawsuit against the county road department. Without our blanket liability policy we would have been completely ruined. Of course, the cost of fully insuring for liability is high; our yearly BLP premium is over \$4800 yearly; often a governmental unit is forced to forego some important aspects of coverage.

There are two main hazard groups. One is the damage that may be caused to an individual working within your own organization. This is usually not so serious since most county organizations are covered by a state insurance and/or a health and accident policy, though there have been cases when employees, in the hands of certain lawyers, have placed a claim directly against a governmental agency. The other,

the damage that your operation may cause to other persons or outside property is the very serious hazard. The type of accident that may occur to outside property or persons through highway maintenance and construction is almost unlimited in scope. The total judgments levied against your organization through such accidents may easily be larger than your unit's total yearly income. The public seems to be suit-conscious, and almost any technicality appears to be reason enough for haling a county road department into court.

Is your organization responsible for all accidents caused by it? Definitely not! Your organization is responsible when the personnel or operations have been guilty of negligence. Such negligence may be negative, such as when your organization fails to perform a duty they would reasonably do under normal circumstances. Under normal circumstances, your maintenance crew would repair or thoroughly sign a shoulder washout as soon as reported. Failure to do so would be negligence. However, you may also be guilty of negligence if your organization does something that it would not normally do under similar circumstances. So, the question of negligence is almost always one of decision and interpretation by the courts. Negligence, we have found, is what a jury says is negligence.

In the event of damage, above whatever judgment may be awarded against you, is also the cost of defending your organization against such suits. Investigation for defense means time, effort and funds expended in collecting evidence and



● **WHAT** determines negligence? The decision would be up to the courts if an accident occurred before this washout was posted. Insurance helps protect the County.



● **CONSTRUCTION** work always presents hazards. When injuries occur, blanket liability insurance covers possible individual suits filed against your organization.

procuring witnesses, plus actual court costs. Court defenses make inroads upon your time that could be used to better advantage in your regular pursuits. And you can eliminate all these troubles through the simple expediency of having a reliable agency establish your blanket liability policy.

Municipal and state governments have long had the sovereign immunity to liability suits. Counties, for some untold historical reason, have not enjoyed the same degree of immunity. The operations of road maintenance and construction have long been considered as functions excepted from the general rule of immunity. If the function has been strictly governmental in nature, such as police or fire, immunity appears to be enjoyed in contrast to the proprietary functions of roads and utilities, which have long been sources of legal action as far as lawsuits were concerned.

Since liability is a possibility, and since suits are not unusual, it is only common sense for a road department to spread its risk and avail itself of liability insurance. In this day and age, it is a necessity. Why should this be a blanket liability coverage? Again we use the commonsense approach. Under a blanket liability policy, the premium is no greater than under any other type, yet the coverage is considerably greater. Ordinarily, blanket liability policies will carry fewer exclusions than the specified coverage type of policy; and they are not limited to the existence and/or maintenance and construction of roads. Modern road departments are practically public works organizations, involved in sewerage, water and other activities not closely related

to roads. Under specified coverage, an accident could occur which would be excluded. Blanket liability would cover these additional activities, providing the best possible source of protection at the lowest price.

Under separate coverage, there is always the possible claim arising where it is difficult to distinguish as to what coverage would apply. Should a county carry an automobile and an "other" than auto liability policy, it is conceivable an accident could occur which the company might decide is not covered under either policy. This could not happen on a policy of blanket liability, since the definition of automobile on the policy serves only to direct the company as to which coverage will apply, not whether it will apply.

Complete Analysis of Needs

Our Board of County Commissioners felt the best method of acquiring adequate coverage was to have a complete analysis of our needs by a highly reputable agent. To accomplish this, the Board called in Dave Dorsey, General Insurance of America agent. Our insurance was placed on a five-year plan, with one-fifth coming due yearly. Each year, Mr. Dorsey audits our coverage completely, bringing us up-to-date on fire, comprehensive collision and blanket liability. He has helped broaden our coverage where needed, and limit it where hazards are remote. And here we would caution officials against trying to select exposures where coverage is needed. A good insurance company will vary the premium with the exposures, and those exposures being slight will have lower premiums. If a county could select in advance where its loss was going to occur,

then it could be prevented, and there would be no need for insurance. Our agent quickly convinced us that by blanketing our liability protection we are avoiding loopholes and getting the most for our insurance dollar.

What should you expect from an insurance company? You should be given a careful analysis of needs, prompt servicing of policies and claims, and complete confidence and honesty in representing you in insurance matters. Your agent should supply you with advanced coverages geared to modern operational needs. Claims service should be readily available. General of America have two staff adjusters in our area. And we have often had a man at the scene of an accident within 45 minutes. This has assured a prompt and fair settlement of claims. Prompt handling of all damage claims has definitely improved our public relations. An insurance company should be aggressive and willing to change to meet all new conditions. A special agent service bringing these changes to us has eliminated our "lost soul" feeling in the event of need.

A county should select an agent and a company and do business with them over the long term. There should be an initial understanding that, as long as the service is good and the premiums fair, business will continue with the one organization. County insurance up for yearly bid is not a good risk for an insurance carrier, for if the carrier has substantial losses, it would be difficult for them to come out even. In such an event, companies would refuse to bid, or bid high. We have found some counties following this policy that are out of a market, and others paying an exorbitant price. We felt that insurance could not be undertaken on a long range basis and still be shopped out every year to the lowest dollar bidder.

We have not felt the need of meeting price competition, doing all our business with the one agency. The slight difference in premium is more than offset by an understanding of our needs, better service and a high degree of personal interest in our problems. Our company has offered the use of their highly trained safety specialists, since the long pull with them makes it worthwhile for them to invest their safety engineering staff in our interests. This not only saves the company money in losses, but saves us many premium dollars by restricting our losses to those unavoidable accidents that occasionally occur.

MUNICIPAL INCINERATOR SELECTION

MUNICIPALITIES contemplating the installation of new incinerator facilities now have quite a wide range of new and improved equipment to choose from, and we will try to outline herein the pros and cons of these various designs for the benefit of those involved in their selection.

As incinerator design is a quite special and different type of engineering from that generally encountered by the average civil or mechanical engineer, only those with training and experience in such work should be employed, as failure to achieve satisfactory performance can be very costly and troublesome to all concerned.

The first step should cover the determination of the average amount of refuse to be burned, as well as its general characteristics, and variations from day to day and by seasons. Such information may be available from the existing disposal records but if such records have not been kept, then they should be set up and tabulated for a representative period, preferably including both warm and cold weather seasons. For a preliminary approximation, the figure of 3 lbs. of refuse per day per capita is a fair average for many localities. Typical days of the week load curves are shown in Fig. 1, while seasonal variations are given in Fig. 2.

The next step should include finding a suitable site for the incinerator, reasonably close to the load center, in either an industrial section or an area where the flow of trucks into and out of the plant will not be too objectionable. The modern incinerator plant, like many modern industrial buildings, may be kept low and attractive, with dust collectors and short stacks.

A hillside location is advantageous and can take care of several elevations with a minimum of ramp construction or excavation. When it is

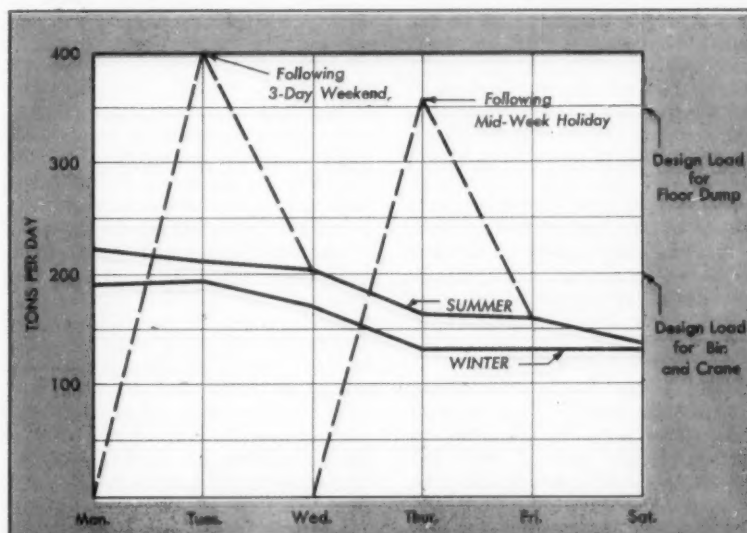
H. G. MEISSNER, P. E.
Engineering Department
Combustion Engineering, Inc.

possible to locate the incinerator close to a sewage disposal plant, the hot gas from the furnaces can be used in flash dryers for the sewage sludge, and the dried sludge may be incinerated when it is not marketable as fertilizer. It may also be profitable to utilize the waste heat for hot water or steam generation.

The third step is to determine the operating period for the furnaces, whether this will include one, two or three shifts. The incoming trucks almost always arrive in the normal daylight shift, say between 8 a.m. and 4 p.m., but with proper storage and reclaiming facilities, the actual burning can be carried out around the clock if desired. The majority of modern plants are operated for either two or three shifts, for reasons noted hereafter.

The popular rating system for incinerators has been the tons of refuse per day which could be fired, but unless we specify the number of hours per day during which this operation is carried out the furnaces cannot be properly sized. A furnace rated at 300 tons per 24-hr. day will burn 100 tons in 8 hrs. and 200 tons in 16 hrs. Such a furnace would be about right if the refuse deliveries averaged 100 tons per day, and it was operated for one shift only, but it would be much too big and costly, if used for the same intake, on a 24-hr. operating schedule. All such furnaces should actually be designed on the basis of lbs. per hr. burned, or on the recently proposed million Btu per hr. in the refuse fired, so that both the daily deliveries and the hours of operation must be determined before the furnaces are selected.

It is of interest to note here that a survey of engineering practices covering municipal incinerators by the



● FIGURE 1. Variations in collection of combined refuse, based on tabulations in the APWA text, "Refuse Collection Practice," with modifications by the author.

U. S. Public Health Service showed that the median of reported 8, 16, and 24-hr. operational and maintenance costs were \$1.40, \$1.00 and \$0.48 per ton per furnace per day respectively. In other words, the longer operating period showed a material saving in per ton costs, which should be kept in mind when designing the plant and related components. Confirming this report a recent tabulation showed that out of a total of 64 plants, 85 percent were designed to operate for two or more shifts.

The fourth step, also related to the operating period, is the determination of the method of handling the refuse at the incinerator, whether or not there will be provision for

With such an arrangement there is very little storage space and refuse must be fired as fast as it is delivered to avoid cluttering up the charging floor. As it is difficult to space the trucks evenly during the day, and waiting trucks are a waste of money, many such plants have been designed with excess furnace capacity simply to take care of the short peaks when several trucks come in together and the refuse must be burned in a hurry. Fig. 3 shows a typical hourly load curve of deliveries indicating design load for both floor dump and bin and crane facilities. Note effect of holidays on deliveries.

The same lack of storage capacity makes it necessary to burn all the

dumping area, or carried along to the charging hoppers as desired. The bridge crane is the more versatile type, as well as the more costly. With it the bin can be of any desired width, although for practical reasons this is generally limited to 30 ft.

As the trucks generally discharge their refuse into only one side of the bin, and the angle of flow of refuse is quite steep, the wide bin requires help from the crane to move the rubbish from the near to the far side as it accumulates. Another factor limiting bin width is the length of the bridge for the crane, which must of course span the bin with something over on both sides for bucket travel. Excessively wide bins with long bridges are therefore uneconomical.

The monorail crane can move in one direction only, that is parallel to the center line of the bin or rail. This construction entirely eliminates the bridge, so is considerably lower in first cost, but it is also limited in its range, especially as regards the width of the storage bin. If this is too wide the bucket cannot reach refuse deposited along the sides, where the material may stand up almost straight because of its tendency to mat and cling together.

In practice the width of the bin is limited to 2 or 3 feet more than the overall width of the bucket, when the latter is in its wide open position. Then the pointed tines can scrape the refuse down along the sides of the bin as the bucket is lowered.

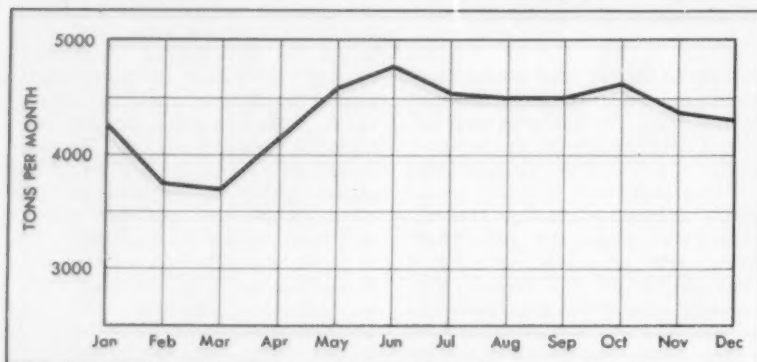
Note that for the monorail crane, the bin should be located at one end and in line with the several charging hoppers to avoid a curved track, which is generally desirable.

Cranes

The choice of crane types will frequently be dictated by the plant layout, but the above limiting factors should be kept in mind so that a mis-application will not result.

The need for a spare crane is debatable, as the money tied up in this item can be put to better use elsewhere. With a reasonable stock of spare parts on hand, and a well trained crew, most routine repairs such as replacement of worn cables and bucket parts can be taken care of during week-end or overnight shutdowns. It is wise to provide for storage of a possible future spare bucket or crane at one end of the bin.

With a properly designed ramp and dumping layout, trucks can unload as soon as they arrive while



● FIGURE 2. Variations in collection of combined refuse, Bethesda, Md., 1956.

storage of refuse between the time it is delivered and when it is fed to the furnaces. Most municipal refuse is very bulky, weighing between 250 and 350 lbs. per cu. yd. or 9.25 to 13 lbs. per cu. ft. without compaction, compared with a fuel such as coal which weighs about 50 lbs. per cu. ft. Storage bins must therefore be very much larger than would be required for most materials.

A further problem is that refuse will not flow out of a large bin or hopper as will a granular material like coal so that special provision must be made to remove it from storage when required. Refuse tends to mat and cling together and has a very steep angle of repose, standing almost vertically when compacted.

Refuse Handling

Many of the smaller incinerators are designed with floor dumps, that is the refuse is discharged from the delivery truck directly onto the charging floor, from which it is subsequently pushed either manually or with a small bulldozer into openings in this floor, located over the furnace.

refuse the same day it is delivered. Because some days of the week show much greater collections than others as shown in Fig. 1, the furnaces must be large enough to take care of these peak days also. With such a floor dump refuse handling system the furnaces must thereafter be sized quite liberally, and the charging floor should also be of ample area.

The installation of a storage bin or pit eliminates some of the above peak loads on the furnaces, which can then be sized for considerably less capacity to handle only the average hourly load. However, removal of the refuse from this bin requires equipment especially designed for the bulk and arching tendency of normal refuse. The low bulk density requires both large storage capacity and correspondingly large handling equipment.

The most popular equipment for this purpose has comprised either a bridge or monorail crane, connected to a clam shell bucket or grapple. With this combination the refuse can be picked up from various parts of the bin, and moved to other sections for mixing or clearing the

the crane operator keeps the near side of the bin clear for this purpose. Also this handling tends to mix the refuse so that wet and dry ingredients are blended for easier combustion. In the case of floor dump layouts, more careful scheduling of the truck arrivals is required to avoid pile ups.

It should be noted that garbage, discarded fruits and vegetables, animal carcasses and similar high moisture material cannot be incinerated without help from more combustible fuel to keep the furnace gas temperature high enough for the rapid drying, which is the primary reaction. Ample dry rubbish such as paper, cartons, crates and similar combustibles is normally available for this purpose, so auxiliary oil

ilar oversized combustibles is, however, desirable to enable such items to pass through the hoppers.

There is some salvage value in the cans and tramp metal, which may be picked out by magnetic pulleys or cranes, and either baled or loaded into trucks. Paper, rags and bundled cartons may also have salvage value.

In some localities unburned cans have been salvaged for their tin, zinc, solder and iron content, but the salvage market is so variable that provision should be made in the plant design for the incineration of all the refuse collected except that which is too large to pass through the furnace, or is of a hazardous nature such as oil drums or similar containers which may contain explosive substances.

been limited to about 150 tons per day, so that a 500 or 600-ton plant would require 4 such units. During the past few years, unit capacities have been gradually increasing, especially since the advent of the continuous feed types, so that today it is possible to install two 250 or 300-ton units for such capacity, with a marked reduction in first cost, labor and maintenance.

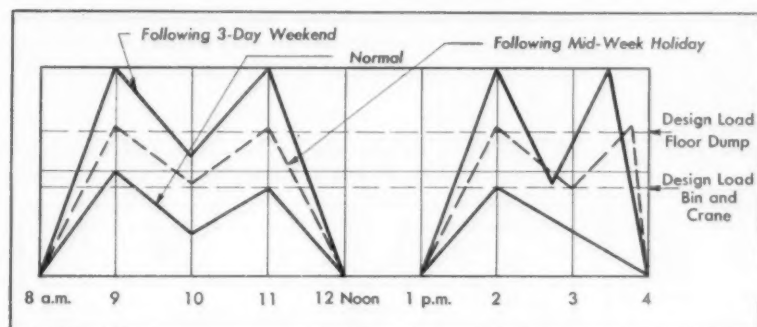
Some designers have preferred to install several small sized furnaces, with the thought that if one should break down and require time out for repairs, the remaining units could carry on with the job. There was a time when this theory was widely held in the power plant field, but experience has shown that there is less chance of trouble with one or two well designed and operated large units than with a number of carelessly maintained small ones.

In a recent case, for a 500 ton incinerator, the purchaser was able to buy two 250-ton traveling grate continuous feed furnaces, of the most modern type, at a lower price than that for the alternate of four 125-ton batch feed units. For similar equipment, the cost of the two large units might be only two-thirds that of the four smaller ones, with corresponding savings in labor and maintenance. It is generally necessary to figure on one operator for each furnace, more or less regardless of its size, and repair costs are likely to be in proportion to the number of units.

In modern furnaces refractory repairs can be made on individual portions of the walls or arches because of the sectionally supported air cooled construction now in common use. In this design the furnace tile are supported on metal clips or hangers, which are bolted to steel buckstays for the side walls and beams across the top for the arches. The repair of spalled or broken tile can be accomplished without tearing down and rebuilding the entire wall, as is frequently necessary with solid or gravity walls. What used to be a week's job has therefore become an overnight or weekend chore which may be taken care of by the plant maintenance personnel, with little or no impairment in plant capacity.

Equally satisfactory results may be obtained by use of the plastic refractories now available, which also may be sectionally supported. These can be used for the entire furnace or for patching material when minor repairs are needed.

By use of such improved materials and methods, spare units are



● FIGURE 3. Hourly deliveries during a typical day under various conditions.

burners or the use of coal is generally unnecessary. However, the crane operator can help materially by watching for the discharge of such garbage into the bin and moving it to the top of a pile of dryer rubbish before loading it into the charging hoppers. With the floor dump system the bulldozer should do as much mixing as possible to avoid smothering the furnace with a load of wet garbage or market refuse.

Sorting Refuse

Suggestions have been made that such non-combustibles as cans, bottles, metal containers and tramp iron be removed before the refuse is fed to the furnace. However, experience has shown that such material tends to keep the fuel bed open and porous, so that the combustion air can pass through more readily. The same applies to crates, cartons, and other rather bulky rubbish, which burn more readily when they are not flattened or compressed. Shredders have been tried in some cases, but discarded for the above reasons. Their use in connection with tree branches, lumber or sim-

It seems obvious that items such as bed springs, metal refrigerators, hot water boilers, and baby carriages should not be delivered to the furnaces, but should be collected separately and disposed of directly to the dump.

The well designed incinerator should have charging hoppers or gates that will take material up to about 4 ft. in its maximum dimension, to avoid trouble from the large crates, cartons and other containers now in use. Undersize hoppers may prove an endless source of trouble because of fouling and inability to pass much of the delivered refuse.

Furnaces

The fifth step comprises selection of the incinerator furnaces, which cannot be done with the greatest efficiency and economy until the above steps have been determined. Their selection offers the designer quite a wide choice, which we will try to summarize for his convenience.

An important factor in the cost of the plant is the number and size of the furnaces installed. In the past, individual furnace capacities have

unnecessary, as a well kept preventive maintenance program will eliminate all but the most unusual breakdowns. Fallen arches need no longer be a constant hazard in the modern incinerator.

The two factors that cause the most trouble and maintenance expense are slagging and spalling. The former is generally due to ash build-up caused by excessive furnace temperatures, which the operator can and should avoid, while the latter is caused by extreme changes in temperature, which occur whenever the furnace is charged or cleaned.

Short time or one shift operation has been found very detrimental in

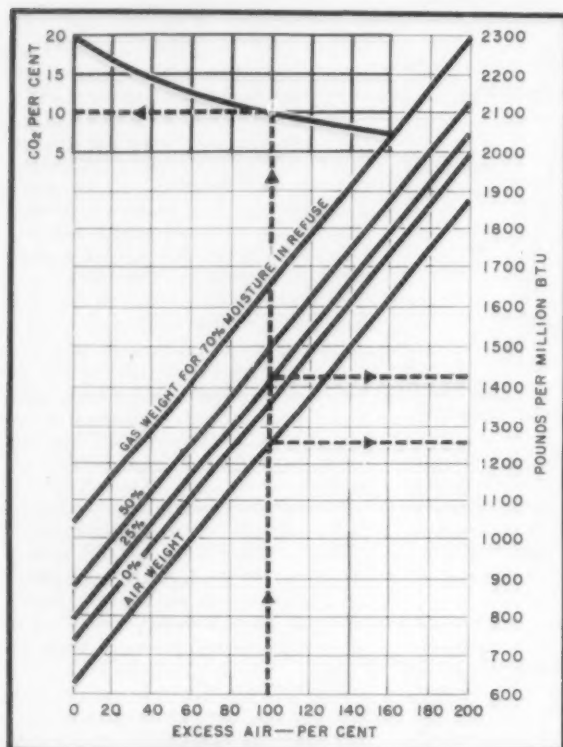
past generation or so, and this must be taken into account in the design of pick-up, handling, storage and furnaces. The amount of dry combustible material such as paper, cartons, plastic bags and containers has increased greatly, while quantities of garbage and similar high moisture ingredients have dropped off. These changes are due largely to our higher standard of living, and the advent of prepared and packaged food products.

The apparent variations in refuse as received are more an illusion than a reality, as many experienced engineers are finding. For example, a well known western university reports as follows on this matter:

the weather, but this variation can be largely counteracted by proper control of the excess air as covered below. Furnace temperatures need not vary so widely that incineration capacity or efficiency will be unduly affected, and the use of auxiliary fuel is seldom if ever necessary.

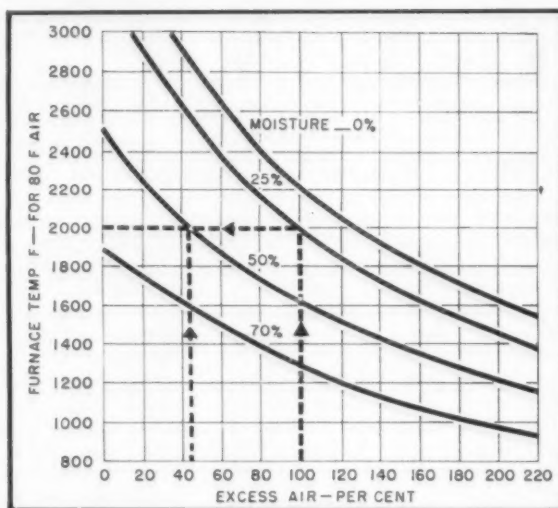
Combustion Calculation

Taking advantage of the above, calculations for the determination of furnaces and associated equipment have been greatly simplified during the past few years by converting the refuse weights to be fired into the heat unit long used by power plant designers, the British thermal unit or Btu. Instead of talking about



● FIGURE 4. Air and gas weights computed on the basis of refuse as a fuel. Variables such as moisture and non-combustibles found in refuse have very little effect except on the gas weight and the furnace cleaning interval.

● FIGURE 5. Relationship of furnace temperatures with various conditions of excess air and moisture in the fuel.



this respect, as the furnace is heated up quickly in the morning and cools down during the overnight idle period. The alternate expansion and contraction of the brickwork causes pieces of refractory to break loose and fall out, or spall. When the furnaces are operated continuously for two or three shifts, the brick temperature remains much more uniform, greatly reducing this spalling. Thus furnace life is extended and repair costs reduced.

Refuse Characteristics

Refuse characteristics have changed quite radically during the

"Analysis made of samples of the refuse burned during the tests showed that the heat of combustion on moisture and ash free basis was very close to that of cellulose—8000 Btu per lb.—regardless of the chemical composition of the fuel. This fact simplified the calculations on the heat process, and made it possible to predict the behavior of the material when it was burned. The most important variable was the moisture in the refuse, which is considered as the burden, or the energy-consuming load on the incinerator."

It is true that the moisture will vary from day to day, depending on

the number of tons or pounds per hour to be fed to the furnace and selecting the grate and furnace sizes on the weight unit, the refuse is analyzed for heating value, or compared with known material, and its net Btu value is then multiplied by the lbs. per hr. to be fired to obtain the total heat input, usually expressed in million Btu per hr.

Combustion engineers have known for years that the air requirements for complete combustion of most solid fuels are quite uniform on the Btu basis, many of the variables such as moisture and non-combustible matter having little if any effect

except on the gas weight and furnace cleaning intervals. Having established this concept, we can then calculate and plot the air and combustion products, for the most usual operating conditions, as shown in Fig. 4.

The major design factors are then developed from the above starting point as shown in the following example. Much of this data can be tabulated for the various incinerator sizes in common use, or expressed in curve form, as found most convenient. This procedure follows the methods used in the design of furnaces for many other more standard fuels, such as coal, hogged wood and bagasse as well as fuel oil and natural gas.

Illustrative Example

In the following example we have assumed a refuse having a moisture and ash free heating value of 8,000 Btu per lb., with 25 percent moisture and 12.5 percent ash (inert material). The as-fired heating value is therefore $8000 \times [1 - (0.25 + 0.125)]$ which equals 5,000 Btu per lb.

For 100 percent excess air, which is required to hold the furnace temperature at or below 2000° F, as shown in Fig. 5, the air weight per million Btu is 1250 lb., and for the above 25 percent moisture in the refuse, the corresponding gas weight is 1426 lb. per million Btu.

If the rated capacity is 100 tons per 24 hrs., or 8,340 lbs. per hour, the total as-fired heating value per hour becomes $8,340 \times 5,000 = 41.7$ million Btu. The grate area at 300,000 Btu per sq. ft. per hr. heat release is $41.7 \div 300,000 = 139$ sq. ft. The furnace volume at 20,000 Btu per cu. ft. per hr. is $41.7 \div 20,000 = 2,085$ cu. ft. The furnace height required becomes $300,000 \div 20,000 = 15$ ft. The total air weight required at 100 percent excess air is $41.7 \times 1,250 = 52,100$ lb. per hr. The air volume including furnace leakage at 100°F is 12,300 cfm, and the air supplied by forced draft and over-fire fans is 85 percent or 10,450 cfm. The gas weight leaving the furnace is $41.7 \times 1,426 = 59,400$ lbs. per hr. The gas volume corresponding to this weight at 2,000°F is 61,200 cfm.

From this gas quantity we can determine the velocities in the furnace as well as required flue area for any desired gas velocity, together with chimney size and other data.

The vertical gas velocity above the fuel bed is $61,200 \div 139 = 440$ ft. per min. The horizontal gas velocity at the furnace outlet for a

furnace width of 8 ft. is $61,200 \div (8 \times 15) = 510$ ft. per min. The cross-sectional area in the chimney or flue at 2,000 ft. per min. gas velocity is $61,200 \div 2,000 = 30.6$ sq. ft.

These values are easily converted to the weight basis, such as per ton of rated capacity, or similar units, for comparison. We start by moving the decimal point in the above example, two places over. One ton per day equals 83.4 lb. per hr., equivalent to 417,000 Btu per hr.

The combustion air becomes 521 lb. per hr. per ton of rated capacity. The gas weight at 100 percent excess air is 594 lb. per hr. per ton. Equivalent weight at 50 percent excess air is 467 lb. per hr. per ton or 1110 lb. per million Btu per hr. The combustion rate in lb. per sq. ft. per hr. is $300,000 \div 5000 = 60$ lb. The furnace volume becomes $417,000 \div 20,000 = 21$ cu. ft. per ton.

The dust loading limitation set by the ASME model code of 0.85 lb. of fly ash per 1000 lb. of gas at 50 percent excess air, converts to $0.85 \times 1110 \div 1000 = 0.943$ lb. per million Btu.

Fan sizes are obtained by taking the above air and gas volumes, together with static pressures based on test data, and adding the standard fan tolerances, in accordance with established power plant practice.

It will be noted that variations in the unit heat value, which affect all other results, are taken care of by correcting for moisture and ash. For an as-fired 4000 Btu refuse, having for instance 50 percent moisture plus ash content, the total heat input becomes 33.4 million Btu per hr. For industrial refuse, which may average 6000 Btu per lb. or more as fired, this heat input becomes 50.0 million Btu per hr. The design should therefore be based on the highest average unit heat value that may be expected, and the resultant million Btu total is that used in subsequent calculations.

Batch Feed Furnaces

The incinerator designer has two general types of furnaces to choose from, the long used batch feed design, in which the refuse is dropped periodically directly onto the fire from a hopper, and the continuous flow hopper feed type. The latter has a much larger hopper that is kept filled by the charging floor operator. Refuse is removed continuously from the hopper bottom by means of the moving grate surface beneath.

Batch feed furnaces are in general lower in first cost and unit capacity, hence most suitable for plants burning less than say 150 to 200 tons per

day. These furnaces come in two general types, having either circular or rectangular grates. Each of these types has some form of grate mechanism which is designed to keep the refuse agitated and burning actively, and to aid in moving it down toward the dump trays, to facilitate removal of the residue as it accumulates. Some manual attention is required, especially during the cleaning operation, so that one operator is generally assigned to each unit.

One difference in the design of these various batch feed furnaces is the number of charging gates per furnace, which has a quite definite effect on the operation.

The circular furnace has a single charging gate which is located over the center of the furnace. The furnace is charged at short intervals, the fresh charge falling directly on top of the pile of burning refuse. The refuse forms a cone shaped pile which gradually burns down, combustion taking place largely on the surface of the pile. Combustion air is supplied through the grate and through the central cone, preferably from forced draft fans.

Rabble arms attached to the bottom of the central cone revolve slowly and feed the refuse down to the dump grates, from which the residue is removed periodically. These grates are raised and lowered either manually or by power cylinders. The latter reduce labor and speed up the operation materially.

When the dump grates are lowered, usually one at a time, the operator rakes down the accumulated residue, comprising cans, bottles, ashes and other non-combustibles into the ash pit, working around the furnace, through four equally spaced cleanout doors.

During the cleaning period the feed hopper slide gate is closed to avoid entrance of cold air and so that no refuse can be fed during this interval. Unless very carefully operated the incinerating capacity drops for an appreciable time, depending on the amount of residue on the grate and the skill of the operator. To make up for this lost time, the furnace may be forced beyond its normal capacity when refuse feeding is resumed.

As this cleaning operation must be carried out several times each shift and is by far the most troublesome period, every effort should be made in the design of the plant to facilitate this work by providing adequate operating space, power dump grate mechanism and ample furnace capacity.

The rectangular type incinerator is generally fitted with two or more charging gates and hoppers, so that one section only need be inactive during the cleaning period. The remaining sections continue in operation and maintain the furnace temperature at or near normal. This not only reduces brickwork spalling, but improves incineration, as the refuse cannot burn properly unless the furnace temperature is kept at a high enough value to ensure rapid drying and burning of the combustibles.

Furnaces of this type are fitted with movable grates which rock or reciprocate in such a way as to carry the burning refuse from the charging end to the dump grate, usually with some help from the operator. These grates are then dumped and the residue discharged in a manner similar to that of the circular furnaces. A typical installation may have a rocking grate stoker, a hopper for bin and crane refuse handling and a multiple container for residue disposal. The hopper is designed to hold a grab bucket full of refuse directly on top of the slide gate, which is divided into a right and left half for ease in handling. The crane operator keeps this hopper filled to the floor level at all times.

When this gate is opened, the refuse drops onto the partly burned out fuel bed. The slide gate is then closed and the hopper is refilled, ready for the next charge. As the refuse burns down it is moved along by the action of the rocking grates until it reaches the dumping section, where final burnout is completed.

The residue is then discharged into a hopper which is fitted with adjustable bottom plates, so designed that the residue can be deposited into any one of three or more sealed containers. The latter are mounted on tracks, and can be rolled into position by hand. As each container is filled it is moved along and replaced by an empty container, the filled ones being picked up and carried to the dump by truck during the day shift, or left in place overnight and removed next morning. This arrangement permits two or three shift operation of the furnaces, with residue hauling during the day shift only. Should all containers become filled, the bottom plates may be closed and the hopper used for storage. Properly placed sprays quench the residue as it is discharged.

The residue must be dumped several times each shift, depending on the burning rate and amount of non-

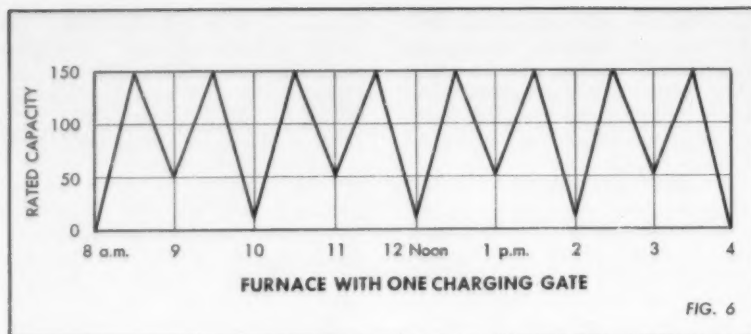


FIG. 6

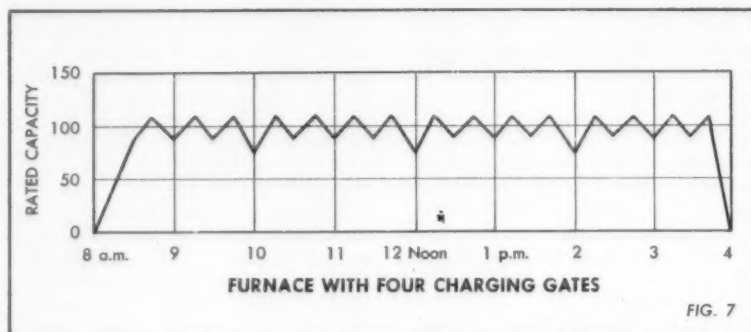


FIG. 7

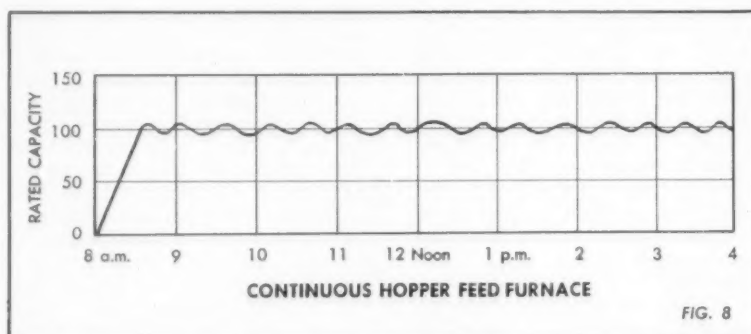


FIG. 8

● DAILY operating cycles for three designs as plotted by the author with the assistance of Leo Flood of the Dept. of Air Pollution Control, New York City.

combustible in the refuse. There is some loss in capacity during this period.

Continuous Flow Furnaces

Continuous flow hopper feed incinerators are made in several types, including traveling and chain grates, revolving kiln, rocking or reciprocating grates, or combinations of these elements. In contrast to the batch feed types, the refuse is removed from the bottom of the feed hopper at a slow continuous rate by the action of the stoker mechanism, the hopper being kept full at all times.

In one of the most advanced types of continuous feed incinerators, the traveling grate carries the refuse progressively over a number of damped air compartments, so ad-

justed that the combustion air is admitted only at the points where it is required. The refuse is first dried, then begins to burn as the volatile matter is driven off, and finally the solid combustible is burned out as the grate reaches the discharge end and the residue is dumped into the ash pit.

The rotating kiln, and reciprocating grate and constant-flow rocking grate types are of somewhat more recent design and limited in practical application, but their development indicates the trend towards more automatic and continuous flow of the refuse through the furnace, and elimination of the hills and valleys which are inherent in the feed and combustion rates for the batch feed furnaces. The charts in Figs. 6 and 7 show capacity variations for

one and four charging gate batch feed furnaces, while Fig. 8 illustrates the more uniform output obtained with the continuous feed type of furnace.

One major advantage in the continuous flow type of incinerator is that the operator has much better control over the fuel to air ratio, which varies in the batch feed furnaces because of the over and under feeding as the charging gates are alternately opened and closed. The absence of cleaning periods permits sustained operation at the design capacity for days at a time, so that average burning capacities are normally higher than for the batch feed furnaces. For the same reason the furnace temperature is much more uniform which reduces brickwork maintenance due to spalling and slagging. The well deserved and increasing popularity of this type of incinerator suggests its careful consideration for all capacities above 200 tons per day, and for even smaller plants where the utmost in satisfactory performance is desired.

Other Considerations

Combustion control equipment, including suitable draft gages and temperature recorders, is highly desirable, and should be of the best quality for long life and reliability. The furnace temperature may be held quite uniform by regulation of the excess air, and thermostatic controls are available for the purpose. This temperature may change too rapidly for the operator to correct, or it may occur when the operator is busy cleaning the furnace or with other essential chores, but the thermostat can catch the changes before they become pronounced and make quick corrections to suit. The excess air is measured by CO_2 or the more efficient O_2 recorders now available.

Draft gages in the various wind-boxes and air ducts will indicate normal or abnormal conditions, such as burned out or overloaded fuel beds as well as dirty gas passages and excessive furnace drafts. They should be of the multi-pointer type, with large, easily read scales, fully enclosed for cleanliness. Power plant practice can be followed in the selection of such equipment, which has been greatly improved during the past few years.

Overfire air, that is, combustion air introduced above rather than through the fuel bed, is essential for the highly combustible refuse now encountered. To be effective this air must be supplied by forced draft fans, with sufficient velocity to

create turbulence and proper mixing with the combustible gases.

Each type of furnace has its own requirements, but in general well over half of the total air should be blown in above the fire or in the combustion chamber. When most of this air is supplied under the grate, the resultant air and gas velocities pick up and carry over light particles of paper and trash, thus increasing the dust load to an undesirable extent. Air introduced above the fire helps to burn out the combustible gas and to reduce excessive furnace temperature but does not increase the dust loading.

Residual handling and removal deserves considerably more attention than it has received in the past. With improved furnaces and better combustion control equipment there should be very little unburned refuse. For combined collections the residue will average about 0.65 cu. yd. or 520 lbs. per ton of refuse fired. The simplest residue handling method in common use is the hopper with quenching sprays and slide gate. The hot residue is cooled by the sprays as it drops from the grate, and is kept in storage until discharged by gravity to trucks, a conveyor or other removal equipment.

The container system is now becoming popular, permitting overnight operation of the furnace without help from the residue truck.

For the larger plants, conveyor systems are in use, so designed that the hot residue drops into a water filled sump which has a conveyor at the bottom. The conveyor discharges the residue into a truck or containers. The angle of the conveyor trough permits considerable dewatering of the residue and the water level is high enough to form a seal at the discharge end of the grate.

Other forms of conveyors, as well as hydraulic sluices with dewatering tanks, have been used with satisfactory results, the choice depending largely on the engineer's preference, as well as on local terrain and disposal facilities. Mechanization of this part of the plant is generally desirable to improve cleanliness and reduce labor costs.

Clean air laws and regulations are becoming increasingly strict as communities realize that air pollution is no longer necessary, and its harmful effects are more fully appreciated. Just as boiler plants are not permitted to discharge smoke and fly ash, so the modern incinerator need not be an offender in this respect. The well designed incinerator should incorporate adequate provisions for dust and fume prevention.

The furnaces have a definite part in this program, as the temperature in the combustion chambers must be maintained at all times high enough to decompose noxious odors. In general the furnace temperature should not be permitted to drop below 1400°F. , and with careful design and operation, this is a practical requirement.

With adequate furnace volume, the gas velocity is low enough to avoid pick up of most of the burning particles, permitting them to remain in the combustion zone long enough to burn out completely. The fine fly-ash which does pass out of the furnace should then be trapped by a well designed and tested collection system.

Many of the prevailing dry settling and expansion chambers which once were considered adequate have been shown to be quite inefficient and should not be considered for a modern installation. Experience of boiler plant designers can well be followed in this respect, as the various types of locally made settling hoppers and baffled breechings have long since been superseded by well designed commercial collectors, engineered to fit the local conditions, and guaranteed by the manufacturer as to their efficiency.

The use of water sprayed baffled chambers can reduce the fly-ash emission to well below the code requirement, and are in successful use in a number of plants. Their water consumption is generally quite large, and the cost of the suspended refractory walls and baffles may be higher than for a commercial type of scrubber. Much of the spray water may be recirculated.

A dry tubular collector can handle gas temperature to about 700°F. , so the higher temperature gas must be cooled by admission of tempering air or by water sprays before it reaches the collector. When water is used in properly designed fog nozzles it is converted completely to dry, superheated steam, thus absorbing the maximum amount of heat from the gas and reducing the water consumption to reasonable quantities. The water consumption in each of these dust removal systems has been evaluated in previous literature.

The ASME code limit of 0.85 lb. of fly ash per 1000 lbs. of gas corrected for 50 percent excess air is still considered the most practical of any yet proposed. As even a well run incinerator will emit 2.5 to 3.0 lbs. of dust per 1000 lbs. of raw gas, it is obvious that efficient air collector system is required.

THE DESIGN OF PRESTRESSED CONCRETE I-BEAMS

JOHN F. McDERMOTT,
Chief Structural Engineer,
Michigan Associates,
Consulting Engineers,
Lansing, Michigan

THE MOST efficient way to design a prestressed beam is, first, to determine the dead load, live load, and impact unit stresses on the full gross sections of the beam (neglecting the transformed area of any strands or prestress steel). Then the proper initial pre-stressing force is found that will relieve the objectionable tension stresses caused by the dead, live and impact loading.

In Figure 1 are shown the four critical points worthy of investigation. Under a combination of external loadings and prestressing, point *a* will be critical in tension, and point *b* will be critical in compression. Under prestressing alone, point *c* will be critical in tension and point *d* will be critical in compression. Usually, tension at points *a* and *c* will govern the entire design of a prestressed I-beam.

The first step in investigation at point *a* is to obtain the sum of the dead load, live load and impact unit tension stresses. Let us assume that the beam shown in Figure 1 is subjected to a maximum dead load moment on the beam alone equal to 118 kip-ft from the weight of the beam, and 197 kip-ft from the slab and diaphragms. On the composite section (at which the beam and slab act as a monolithic unit) let the maximum moments be 44 kip-ft from railing, sidewalk and

wearing surface and 328 kip-ft from H-20 live load and impact. By using the properties of the beam shown in Figure 1 and defined in Table 1, one can obtain the center-of-span values to place in columns 4, 6, 8 and 10 of Table 2. For example, the flexure stress at bottom of beam due to dead load of beam only is equal to

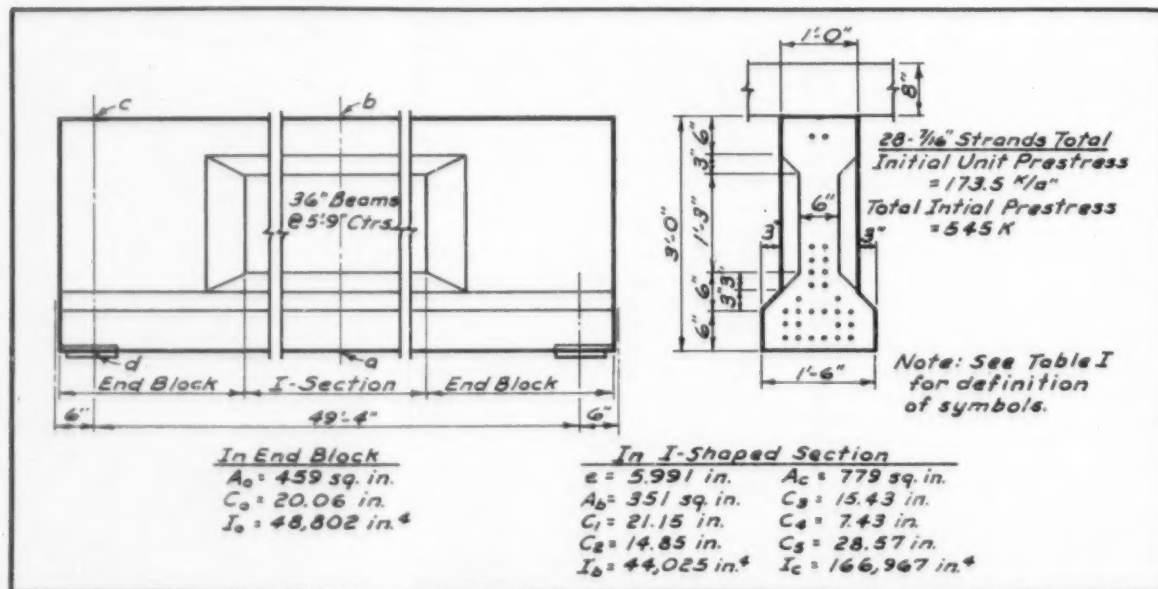
$$\frac{M C_2}{I_b} = - \frac{(118 \text{ Kip-ft}) (12 \text{ in/ft}) (14.85 \text{ in})}{44,025 \text{ in}^4} \\ = -0.478 \text{ Kip/in}^2,$$

which appears in two places in column 4. Also, the flexure stress at the top of the beam due to live load plus impact is equal to

$$\frac{M C_4}{I_c} = + \frac{(328 \text{ Kip-ft}) (12 \text{ in/ft}) (7.43 \text{ in})}{166,967 \text{ in}^4} \\ = +0.174 \text{ Kip/in}^2,$$

which appears in two places in column 10. The minus (—) signs indicate tension stress, and the plus (+) signs indicate compression stress. Stresses in column 4, for the inside edge of the end block can be obtained in like manner with the weight of beam and the weight of the slabs and diaphragms contributing 20.5 Kip-ft and 32.5 Kip-ft respectively.

At the bottom of the beam shown in Figure 1 and tabulated in Table 2, the flexure stresses exclusive of prestress loading may be summarized as follows:



● FIGURE 1. Typical prestressed concrete I-beam. Analysis of critical points *a*, *b*, *c* and *d* are discussed in the text.

| | |
|--|-----------------------------|
| Due to Beam Weight Only | -0.478 Kip/in ² |
| Due to Slab and Diaphragms | -0.797 Kip/in ² |
| Due to Railing, Sidewalk & Wearing Surface | -0.090 Kip/in ² |
| Due to Live Load and Impact | -0.673 Kip/in ² |
| TOTAL | -2.038 Kips/in ² |

Obviously, the final value of the unit compressive prestress at point *a* must be equal and opposite to this sum of stresses from vertical loads if there is to be no tension in the bottom of the beam at midspan. However, in most beams, the initial prestress is about 1.25 times the final prestress. Therefore, one design requirement for the beam is that the initial prestress unit stress at point *a* should be equal and opposite to 1.25 times the sum of all dead load, live load and impact bottom flange unit stresses. Thus, the bottom flange initial prestress unit stress should be at least $(1.25)(2.038 \text{ Kip/in}^2) = 2.546 \text{ Kips/in}^2$. This requirement is defined below in Equation 1.

Examination of stresses at point *c* is next required. Since external loads cause no stresses at the end of the beam, it is sufficient to equate the allowable concrete tension stress (assumed to be 0.4 Kip/in^2) to the initial prestress unit tension stress at point *c*. This requirement is defined below in Equation 2.

It should be noted that the properties of the end block section result in a greater unit tension at point *c* than would be obtained if the I-shaped section were extended throughout the entire length of beam. Therefore, top flange tension will always be most critical in the end block.

Compression stresses at points *b* and *d* in Figure 1 may be investigated in a manner similar to the research done at points *a* and *c*. Sometime during the final stress analysis of the beam, it must be proven that the sum of the prestress unit stress and the total unit stress from vertical loading does not exceed the allowable compression at any location in the beam. However, it is not usually economical to spend time on this investigation when making the original determination of initial prestress.

The most economical strand arrangement and prestress will be that which, in combination with vertical loading, produces a minimum compression stress (near zero) at point *a* and a maximum tension stress (near the allowable) at point *c*. Let P_i and e be the unknown values, respectively, of the total initial prestress and its eccentricity from the gravity axis of the I-shaped section. The numerical values of these unknowns may be obtained from simultaneous solution of Equations 1 and 2 herewith, with P_i and e the only unknowns:

Equation 1 (at point *a*)

$$\frac{P_i}{A_b} + \frac{P_i e C_2}{I_b} = 1.25 \Sigma \text{ Bottom Flange Stresses from Vertical loads}$$

Equation 2 (at point *c*)

$$\frac{P_i}{A_o} - \frac{P_i(e + C_1 - C_o)C_o}{I_o} = -\text{Allowable Unit Tension Stress}$$

Definitions of the symbols are to be found in Table 1. The left-hand portion of each formula consists of the sum of the direct load prestress unit stress and the flexure prestress unit stress (due to the eccentric vertical distance between the center of gravity of the beam cross section and the center of gravity of the prestressing force). The right-hand portion of Equation 1 sets a minimum "allowable" bottom flange initial prestress unit compression stress (2.546 Kips/in^2 in the

problem under consideration). The right-hand portion of Equation 2 sets a maximum "allowable" top flange initial prestress unit tension stress (0.4 Kip/in^2).

Appropriate values of beam properties shown in Figure 1 may now be substituted in Equations 1 and 2.

Equation 1 (at point *a*)

$$\frac{P_i}{351 \text{ in}^2} + \frac{P_i e (14.85 \text{ in})}{44,025 \text{ in}^4} = 2,546 \text{ psi}$$

$$\text{or } 0.00285 P_i + 0.000337 P_i e = 2,546 \text{ psi}$$

Equation 2 (at point *c*)

$$\frac{P_i}{459 \text{ in}^2} - \frac{P_i(e + 21.15 \text{ in} - 20.06 \text{ in})(20.06 \text{ in})}{48,802 \text{ in}^4} = -400 \text{ psi}$$

$$\text{or } 0.00173 P_i - 0.000412 P_i e = -400 \text{ psi}$$

TABLE 1—SYMBOLS

| | |
|-----------|--|
| P_i | Total initial prestressing force |
| P_{cf} | Final portion of prestressing force transferred from the beam alone to the composite section |
| M | Moment from vertical loading |
| M_{bl} | Initial dead load plus prestress moment on beam alone |
| M_{cl} | Initial dead load moment on composite section |
| M_{lrf} | Final dead load plus prestress moment on beam alone |
| M_{cfr} | Final dead load plus prestress moment on composite section |
| e | Eccentricity of center of gravity of prestress from beam neutral axis for I-section |
| C | Distance from stress point to neutral axis of section |
| C_o | Distance from top of beam to neutral axis for end block |
| C_1 | Distance from top of beam to neutral axis for I-section |
| C_2 | Distance from bottom of beam to neutral axis for I-section |
| C_3 | Distance from top of slab to composite transformer section neutral axis for I-section |
| C_4 | Distance from top of beam to composite transformed section neutral axis for I-section |
| C_5 | Distance from bottom of beam to composite transformed section neutral axis for I-section |
| A_o | Cross-sectional area of end block of beam |
| I_o | Moment of inertia of end block of beam |
| A_b | Cross-sectional area of I-section of beam |
| I_b | Moment of inertia of I-section of beam |
| A_c | Cross-sectional area of composite transformed section for I-section |
| I_c | Moment of inertia of composite transformed section for I-section |
| f'_s | Ultimate unit tension stress in prestress steel |
| f'_d | Ultimate unit compression stress in concrete deck slab |
| f'_{cl} | Ultimate unit compression stress in beam concrete at the time of transfer of initial prestress to the beam |
| f'_c | Final ultimate unit compression stress in beam concrete |
| S_{dt} | Allowable unit diagonal tension in beam |
| E_c | Modulus of elasticity of concrete in beam |
| E_s | Modulus of elasticity of prestress steel |
| n | E_s/E_c |

Thus, Equations 1 & 2 are reduced to two equations with two unknowns. These equations are both satisfied by an initial prestressing force P_i of 521,000 pounds and an eccentricity e of 6.07 inches. These values will, theoretically, result in a bottom flange final unit stress of zero at midspan and a top flange unit stress of 0.4 Kip/in² in the end block. For an allowable initial strand tension of 175,000 psi, the theoretical requirement, using 7/16-in. prestressing strands is:

$$\frac{521,000 \text{ lb. initial prestress}}{(0.112 \text{ in}^2/\text{strand})(175,000 \text{ psi})} = 26.6$$

In the final design, 28 7/16-in. strands are used with a total initial prestressing force P_i of 545,000 pounds and an eccentricity e of 5.99 inches.

A re-examination of Table 2 is now in order. This skeleton framework for summarizing stresses has proven to be of great aid to designers in helping them systematize their prestressed concrete beam analyses. Up to this point, only the numerical values in columns 4, 6, 8, and 10 have been determined. Now, the rows in the table concerned with initial prestress only can be computed. For example, the initial prestress loads at the center of gravity of strands for the I-shaped section can be determined for the beam shown in Figure 1. P_i is the total initial prestressing force of 545,000 lb. A_b and I_b are, respectively, the cross sectional area (351 in²) and the moment of inertia (44,025 in⁴) of the I-section of the beam. The distance c (from stress point to neutral axis) is, in this particular calculation, equal to the eccentricity e (5.99 in.) from the neutral axis to the center of gravity of prestress.

$$\frac{P_i}{A_b} = \frac{545,000 \text{ lb}}{351 \text{ in}^2} = +1,550 \text{ psi (col. 1)}$$

$$\frac{P_i e c}{I_b} = \frac{(545,000 \text{ lb})(5.99 \text{ in})(5.99 \text{ in})}{44,025 \text{ in}^4} = +444 \text{ psi (Col. 2)}$$

$$\text{Total Initial Prestress at Center of Gravity of Strands} = +1,994 \text{ psi (Col. 3)}$$

After summations of stresses involving initial prestress have been made, the losses in prestress (which reduce "initial" to "final") can be found. The first requirement for the determination of losses is the calculation of the "long duration" concrete stress at the center of gravity of the strands. This "long duration" stress is assumed to be the total of the initial prestress and the average flexure stress, from end to end of beam, resulting from the dead load of the beam, slab and diaphragms. Other loads are neglected. Computations for the beam shown in Figure 1 are as follows:

$$\text{Prestress Unit Stress} = +1,994 \text{ psi (Col. 3)}$$

$$\begin{aligned} \text{Average Stress from Weight of Beam} &= \frac{2}{3} \frac{M_c}{I_b} \\ &= \frac{2}{3} \frac{(118 \text{ Kip ft})(12 \text{ in/ft})(5.99 \text{ in})}{44,025 \text{ in}^4} = -129 \text{ psi (Col. 4)} \end{aligned}$$

$$\begin{aligned} \text{Average Stress from Slab and Diaphragms} &= \frac{2}{3} \frac{M_c}{I_b} \\ &= \frac{2}{3} \frac{(197 \text{ Kip ft})(12 \text{ in/ft})(5.99 \text{ in})}{44,025 \text{ in}^4} = -215 \text{ psi (Col. 6)} \end{aligned}$$

$$\text{Average Net Concrete Stress at Center of Gravity of Strands} = +1650 \text{ psi (Col. 7)}$$

At the center of gravity of the strands, the concrete (and the prestress steel bonded to it) will undergo a

unit compression strain of 1650 psi divided by E_c , where E_c is the modulus of elasticity of the concrete. Therefore, the reduction in prestress steel unit tension will be 1650 psi (E_s/E_c), where E_s is the modulus of elasticity of the prestress steel. The ratio E_s/E_c is assumed to be 5 for the elastic deformation loss and 11 for the loss in prestress due to plastic flow of the concrete. Therefore, at the center of the span, the elastic deformation loss is (5) (1.650 Kips/in²) = 8.3 Kips/in², and the plastic flow loss is (11) (1.650 Kips/in²) = 18.2 Kips/in². The elastic deformation loss occurs immediately upon transfer of prestress to the concrete and, therefore, can always be considered to subtract from the nominal initial prestress to obtain the realistic initial prestress for pretensioned beams. This realistic initial condition is summarized in Table 2 in the rows entitled "Initial Prestress minus Elastic Deformation Loss."

The other prestress losses that must be calculated for pretensioned beams are due to shrinkage of the concrete and creep of the prestress steel. Shrinkage loss is assumed to be 6.0 Kips/in². Creep loss is assumed to be 4 percent of the initial prestress, which is (173.5 K/in²)(4%) = 6.9 K/in² for the problem under consideration.

In review, the calculation of losses may be summarized as follows:

| | |
|--|------------------------------|
| Initial Prestress | = 173.5 Kips/in ² |
| Elastic Deformation Loss = (5) (1.650) | = 8.3 Kips/in ² |
| Initial Prestress minus Elastic Deformation Loss | = 165.2 Kips/in ² |
| Plastic Flow Loss = (11) (1.650) | = 18.2 K/in ² |
| Shrinkage = 6.0 K/in ² | |
| Creep = (173.5) (4%) = 6.9 K/in ² | 31.1 Kips/in ² |
| Final Prestress | 134.1 Kips/in ² |

The concrete stress at the center of gravity of strands in the end block is +1,745 psi, as shown in Table 2. This concrete stress causes an elastic deformation loss of 8.7 kips/in² and a plastic flow loss of 19.2 kips/in², which result in a final prestress of 132.7 kips/in² in the end block. The end block portion of Table 2 is based on this slightly lower value of final prestress.

It should be noted that prestress loss calculations for post-tensioned beams would be quite similar except that (a) there would be no elastic deformation loss; (b) the shrinkage loss would be less; and (c) there would be additional losses due to cable friction and slippage of the end anchorages.

Once the final prestressing forces have been calculated, the final prestress unit stresses can be determined and Table 2 can be completed. For example, the final total prestress at midspan = (134.1 Kips/in²)(28 strands) (0.112 in²/strand) 421,000 lb. The final bottom flange unit stress may then be computed as follows:

$$\frac{P}{A} = \frac{421,000 \text{ lb}}{351 \text{ in}^2} = +1,199 \text{ psi (Col. 1)}$$

$$\frac{P e c}{I} = \frac{(421,000 \text{ lb})(5.99 \text{ in})(14.85 \text{ in})}{44,025 \text{ in}^4} = +851 \text{ psi (Col. 2)}$$

$$\text{Total Final Prestress} = +2,050 \text{ psi (Col. 3)}$$

$$\text{Total Dead Load, Live Load and Impact Unit Stress} = -2,038 \text{ psi}$$

$$\text{Total Net Bottom Flange Unit Stress} = +12 \text{ psi (Col. 11)}$$

All the other final stresses can be computed in like manner.

Table 2—SUMMARY OF FLEXURE STRESSES IN CONCRETE

| Location of Section being Investigated | Condition of Prestress | Vertical Location in Section | Prestress Loads | | | | | | | | | | |
|--|--|------------------------------|-----------------|---------------------|---------|-------------------------------|---------|-------------------|---------|-------------------|---------|-------------------|----------|
| | | | $\frac{P}{A_b}$ | $\frac{P e_c}{I_b}$ | $1 + 2$ | $\frac{M_c}{I_b}$ | $3 + 4$ | $\frac{M_c}{I_b}$ | $5 + 6$ | $\frac{M_c}{I_c}$ | $7 + 8$ | $\frac{M_c}{I_c}$ | $9 + 10$ |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| I-Shaped Section at Center of Span | Initial Prestress | Center of Gravity of Strands | +1.550 | +0.444 | +1.994 | -0.129 | +1.865 | -0.215 | +1.650 | | | | |
| | Initial Prestress minus Elastic Deformation Loss | Top of Beam | +1.477 | -1.488 | -0.011 | +0.680 | +0.669 | +1.135 | +1.804 | +0.023 | +1.827 | +0.174 | +2.001 |
| | | Bottom of Beam | +1.477 | +1.049 | +2.526 | -0.478 | +2.048 | -0.797 | +1.251 | -0.090 | +1.161 | -0.673 | +0.488 |
| | Final Prestress | Top of Beam | +1.199 | -1.211 | -0.012 | +0.680 | +0.668 | +1.135 | +1.803 | +0.023 | +1.826 | +0.174 | +2.000 |
| | | Bottom of Beam | +1.199 | +0.851 | +2.050 | -0.478 | +1.572 | -0.797 | +0.775 | -0.090 | +0.685 | -0.673 | +0.012 |
| | | | | | | | | | | | | | |
| I-Shaped Section at Inside Edge of End Block | Initial Prestress | Center of Gravity of Strands | +1.550 | +0.444 | +1.994 | Use same as at center of span | | | | | | | |
| | Initial Prestress minus Elastic Deformation Loss | Top of Beam | +1.477 | -1.488 | -0.011 | +0.118 | +0.107 | | | | | | |
| | | Bottom of Beam | +1.477 | +1.049 | +2.526 | -0.083 | +2.443 | | | | | | |
| | Final Prestress | Top of Beam | +1.199 | -1.211 | -0.012 | +0.118 | +0.106 | | | | | | |
| | | Bottom of Beam | +1.199 | +0.851 | +2.050 | -0.083 | +1.967 | | | | | | |
| | | | | | | | | | | | | | |
| End Block Section at Center Line of Bearing | Initial Prestress | Center of Gravity of Strands | +1.185 | +0.560 | +1.745 | | | | | | | | |
| | Initial Prestress minus Elastic Deformation Loss | Top of Beam | +1.125 | -1.508 | -0.383 | | | | | | | | |
| | | Bottom of Beam | +1.125 | +1.196 | +2.321 | | | | | | | | |
| | Final Prestress | Top of Beam | +0.908 | -1.215 | -0.307 | | | | | | | | |
| | | Bottom of Beam | +0.908 | +0.965 | +1.873 | | | | | | | | |
| | | | | | | | | | | | | | |
| "Average" Stress = $\frac{2}{3} \frac{M_c}{I_b}$ | | | | | | | | | | | | | |

Concrete with an ultimate strength f'_c of 5000 psi and an initial strength f'_{ci} of 4000 psi is assumed. In the summaries in Table 2, it is seen that the final allowable compression ($0.4 f'_c = 2000$ psi) and the initial allowable compression ($0.6 f'_{ci} = 2400$ psi) are not exceeded by any practical amount. Tension is not created in the bottom of the beam, and the allowable tension of 400 psi is not exceeded in the top of the beam.

Ultimate Moment Design

After a strand arrangement is found that will produce design stresses under allowables, the ultimate moment capacity of the composite beam can be computed. Let d and kd be, respectively, the distance from the top of slab to the center of gravity of strands, and the distance from the top of slab to the axis of zero stress (neutral axis). The calculations are considerably simplified when it is realized that the concrete stress will not govern the ultimate moment capacity if k is less than $1/3$ (approximately). The basis of this observation is shown in Figure 2.

1) The unit strain in the steel strands is approximately 0.006 prior to compression of top concrete fibers.

2) Tests summarized in the Portland Cement Association Bulletin D6—Concrete Stress Distribution in Ultimate Strength Design show that the ultimate unit strain of concrete varies between 0.003 and 0.004. It is reasonable therefore, to assume a value of 0.0035.

3) In the American Steel and Wire catalog for prestressed concrete wire, the ultimate unit strain of the prestress steel is seen to be 0.013.

4) Between the beginning of strain in the top fiber concrete and the ultimate failures of the concrete and the steel, which are assumed to be concurrent, the concrete undergoes approximately 0.0035 unit strain and the steel undergoes an increment of approximately 0.007 unit strain (from 0.006 to 0.013). "k" is thus:

$$\frac{0.0035 \text{ in/in}}{0.0035 \text{ in/in} + 0.007 \text{ in/in}} = 1/3$$

under the assumption that plane sections before bending remain plane sections after bending.

The simplest commonly used procedure for determination of ultimate moment capacity is first to assume a uniform compression thrust over the depth kd at a unit stress equal to $0.8 f'_c$, where k is unknown. (This total thrust is equal and opposite to the product of the total area of strands and the steel ultimate unit stress.) When, in most cases, k is found to be less than $1/3$, the ultimate strength of the concrete will not govern, and the ultimate moment can be found by multiplying the thrust by $(d-d')$, where d' is the vertical distance between the top of the beam and the center of gravity of the compression area limited by the value of kd . If k is greater than $1/3$, a more exact analysis must be made to determine the unit strain in the steel which is simultaneous with failure of the concrete.

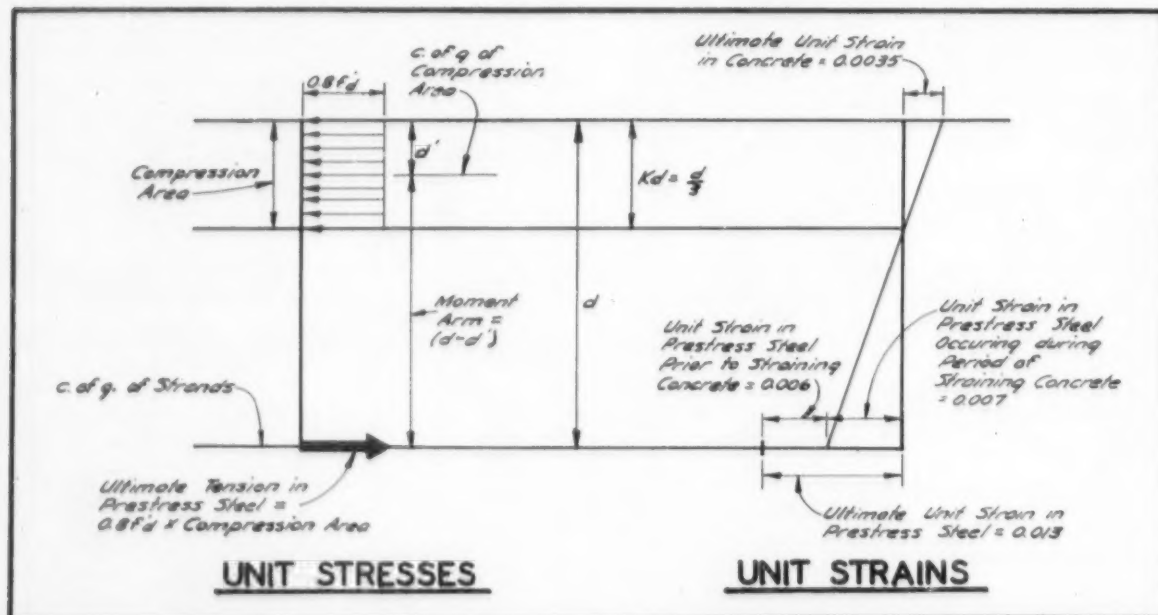
Redistribution of Stresses Due to Plastic Flow

In the period during which the completed bridge is undergoing plastic flow, some of the loading previously carried by the beam alone is transferred to the composite section. This redistribution of loading is caused by the fact that properties of the composite section govern plastic deflections which occur after the slab has hardened. This phenomena of the effect of plastic flow has long been recognized in the design of steel beams composite with concrete slabs. On page 3 of the *Alpha Composite Construction Engineering Handbook* published by the Porete Manufacturing Company, it is stated that tests on composite beams show redistribution of dead load stresses during the lives of the structures tested.

In order to obtain an approximate idea of the redistribution of stresses in prestressed concrete I-beams, the following simplifying assumptions are made (with the admitted realization that a certain percentage of error is introduced):

1) After both elastic deformation and plastic flow, both the final unit stresses and the final unit strains on a section vary linearly over the depth of the slab and over the depth of beam, with discontinuity at the horizontal joint between slab and beam.

2) All plastic flow occurs after the slab has hardened.



● FIGURE 2. Ultimate stresses and strains for balanced design (concrete and steel failing simultaneously).

3) At any section, plastic flow strains vary linearly from top of slab to bottom of beam.

4) The total combined effect of plastic flow and elastic deformation is to reduce the concrete modulus of elasticity from E_c to $E_c/3.25$, as is recommended in the Bureau of Public Roads Criteria for Prestressed Concrete Bridges.

5) The change in total prestressing force is neglected.

The picture equation in Figure 3 adds the plastic flow to the original elastic unit strains to obtain the final unit strains. As this shows, the sum of the initial direct load unit strains on the beam alone; the initial bending unit strains on the beam alone; the initial bending unit strains on the composite section; the plastic flow direct load unit strains on the composite section; and the plastic flow bending unit strains on the composite section, is equal to the sum of the final direct load unit strains on the beam alone; the final direct load unit strains on the composite section; the final bending unit strains on the beam alone; and the final bending unit strains on the composite section.

Simplifying assumptions 1 and 3 result in straight line configurations for all strain diagrams. Note that assumption 4 results in a factor of $E_c/3.25$ in all diagrams on the "final" side of the equation in Figure 3.

Summations of unit strains at the top of the slab, the bottom of the slab, the top of the beam, and the bottom of the beam give four of the equations shown in Table 3. A fifth equation is found in the fact that the sum of the moments before plastic flow is equal to the sum of the moments after plastic flow minus the prestress effect. This effect is the product of the direct load transferred from the beam alone to the composite section and the vertical differential between the centers of gravity of the beam alone and the composite sections. Solution of these five simultaneous equations gives the final moments carried on the beam alone (M_{bf}) and on the composite section (M_{cf}). It also gives the direct load (P_{cf}) transferred to the composite section.

The 36-inch "I" section previously analyzed was chosen for this article because it portrayed a well-

balanced beam stressed near the allowable amounts in both the top and bottom flanges. However, it was thought that redistribution of stresses due to plastic flow would be more pronounced in a deeper section. Therefore, the following data for a 54-inch I-section were substituted in the equation in Table 3:

M_{bi} = Initial dead load plus prestress moment on beam alone

= 1,620 kip-inches (includes effect of eccentricity of prestress force—net effect=compression on top)

M_{ci} = Initial dead load moment on composite section = 1,092 kip-inches (net effect = compression on top)

P_i = Total initial prestressing force = 1,052 kips

A_b = Cross-sectional area of I-section of beam = 789 inches²

I_b = Moment of inertia of I-section of beam = 260,570 inches⁴

C_1 = Distance from top of beam to neutral axis for I-section = 29.26 inches

C_2 = Distance from bottom of beam to neutral axis for I-section = 24.74 inches

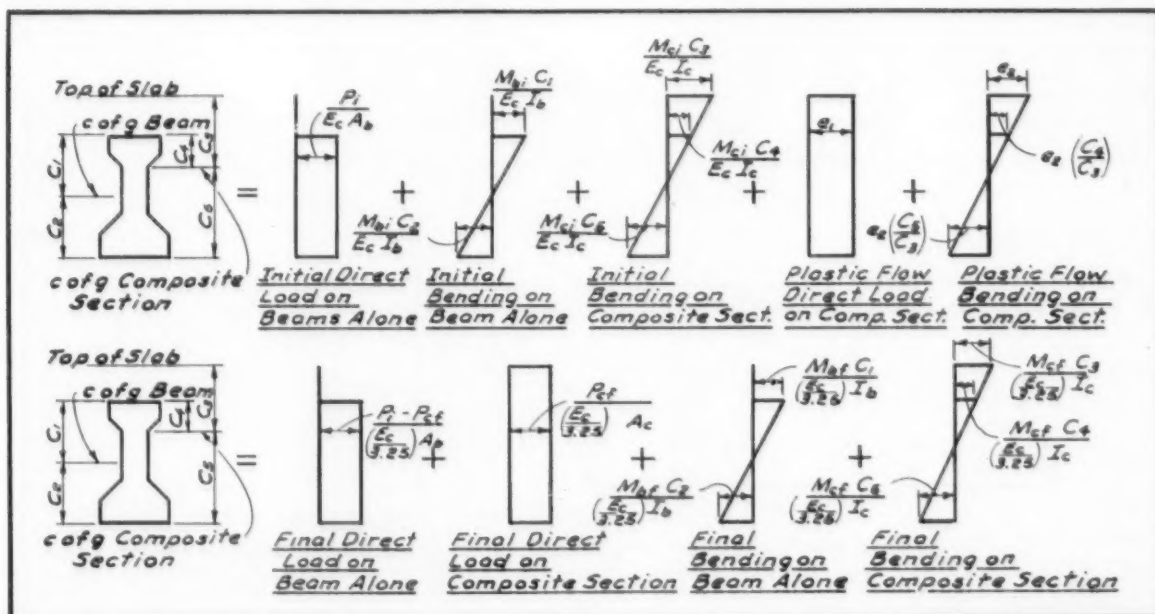
A_c = Cross-sectional area of composite transformed section for I-section = 1,341 inches

I_c = Moment of inertia of composite transformed section for I-section = 622,850 inches⁴

C_3 = Distance from top of slab to composite transformed section neutral axis for I-section = 23.58 inches

C_4 = Distance from top of beam to composite transformed section neutral axis for I-section = 15.58 inches

C_5 = Distance from bottom of beam to composite transformed section neutral axis for I-section = 38.42 inches



● FIGURE 3. Unit strains for plastic flow distribution of stresses in composite beam and slab section.

3. Top of Slab

$$\frac{M_{sl} C_s}{E_s I_s} + e_1 + e_2 = \frac{R_f}{f_{ts} A_s} + \frac{M_{sl} C_s}{f_{ts} I_s}$$

4. Bottom of Slab

$$\frac{M_{sl} C_s}{E_s I_s} + e_1 + e_2 \frac{C_s}{C_b} = \frac{R_f}{f_{ts} A_s} + \frac{M_{sl} C_s}{f_{ts} I_s}$$

5. Top of Beam

$$\frac{P_i}{E_c A_b} + \frac{M_{sl} C_i}{E_c I_b} + \frac{M_{sl} C_s}{E_c I_s} + e_1 + e_2 \left(\frac{C_i}{C_b} \right) = \frac{P_i - R_f}{f_{ts} A_b} + \frac{R_f}{f_{ts} A_s} + \frac{M_{sl} C_i}{f_{ts} I_b} + \frac{M_{sl} C_s}{f_{ts} I_s}$$

6. Bottom of Beam

$$\frac{P_i}{E_c A_b} - \frac{M_{sl} C_s}{E_c I_b} - \frac{M_{sl} C_s}{E_c I_s} + e_1 - e_2 \left(\frac{C_i}{C_b} \right) = \frac{P_i - R_f}{f_{ts} A_b} + \frac{R_f}{f_{ts} A_s} - \frac{M_{sl} C_s}{f_{ts} I_b} - \frac{M_{sl} C_s}{f_{ts} I_s}$$

7. Equation of Statics

$$M_{sl} + M_{sl} = M_{sl} + M_{sl} - P_i (C_s - C_b)$$

● TABLE 3. Equations for plastic flow redistribution of stresses in composite beam and slab section. Summations of unit strains give the first four equations.

By an iteration procedure, it was found that an approximate solution to the five equations was found if M_{sl} , M_{sl} , and P_i were assumed to be 0, 12,300 kip-inches, and 700 kips, respectively. The total resultant pressure distribution on the beam and slab before and after plastic flow are shown in Figure 4. Although the analysis is admittedly approximate, it is apparent that the effect of plastic flow is to raise the pressure distribution on the cross section.

There are two results of this investigation. First, under ordinary conditions of practical design, the labor involved in determining even an approximate stress redistribution is not warranted. Secondly, even though some plastic flow has occurred in the beam prior to erection, part of the initial bending and prestress stresses will eventually be transferred into the slab. This phenomenon should be given recognition in the design for shear transfer between beam and slab, and in calculations of beam deflections.

Shear Transfer Devices

Certain recommendations should be made concerning the design of the shear transfer devices (usually keys) between beam and slab. The factors contributing to shear transfer are horizontal shear from vertical loading and shrinkage of the slab relative to the beam. In regions of maximum shear, the shear caused by vertical loads acts opposite to the direction of the shrinkage force. Thus, the two factors are not additive in design of simple span beams.

As shown above, plastic flow results in redistribution of a large percentage of the load over the composite section. Because of these results, it seems logical to use the total shear in beam and slab in key design (instead of only the shear due to superimposed loads on the composite section).

Due to shrinkage alone, the horizontal thrust per key is equal to the product of the modulus of elasticity of slab concrete, the unrestrained slab shrinkage factor, and the cross-sectional area of slab in the composite beam section. It should be noted that this thrust is independent of the key spacing and the area of the longitudinal steel in the slab.

This shrinkage analysis should be considered in the determination of the minimum size of key. However, only the horizontal shears from vertical loads will determine the key spacing.

Camber

Many different assumptions have been made concerning the camber of prestressed beams. The author is familiar with the results of three different sets of assumptions, which are listed as follows:

1) Assume:

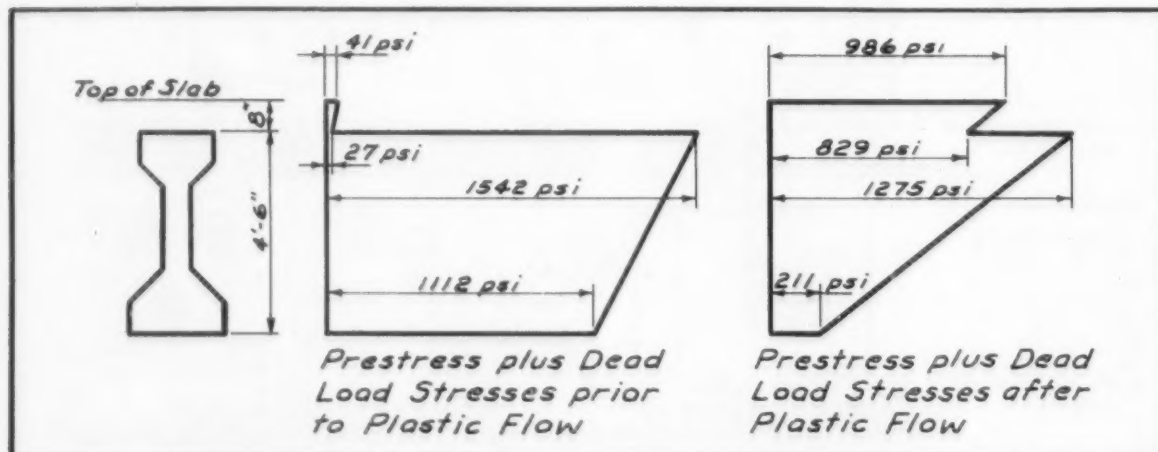
- Initial prestress (minus elastic elongation).
- $E_c = 3,500,000$ psi for deflections due to prestress and weight of beam only.
- $E_c = 5,500,000$ psi for deflections due to all other loadings.
- The weights of beam, slab, and diaphragms are carried by the beam alone.
- The weights of sidewalks, railing and wearing surface are carried by the composite section.

2) Assume:

- Initial prestress (minus elastic elongation).
- $E_c = 5,000,000$ psi for all loadings.
- The weights of beam, slab and diaphragms are carried by the beam alone.
- The weights of sidewalks, railing, and wearing surface are carried by the composite section.

3) Assume:

- Final prestress.
- All loadings are carried through (1) the elastic



● FIGURE 4. Plastic flow redistribution of stresses on a typical composite prestressed beam.

- deformation and (2) the plastic flow stage.
- c) $E_c = 5,000,000$ psi in the elastic deformation stage.
 - d) Plastic flow deformations are 2.25 times the elastic deformations.
 - e) The weight of beam is carried by the beam alone.
 - f) The weights of slab and diaphragms are carried
 - 1) through the elastic deformation stage by the beam alone.
 - 2) through the plastic flow stage by the composite section. (This presumes 100% redistribution of loads from the beam alone to the composite section due to plastic flow.)
 - g) The weights of sidewalks, railing and wearing surface are carried by the composite section.

Assumptions 1, 2 and 3 respectively, roughly correspond to conditions at time of erection (some plastic flow in the beam, but none in the slab), a theoretical condition assuming no plastic flow in either beam or slab, and conditions after all plastic flow has occurred. Over a range of spans from 30 to 80 feet, computations under the three different assumptions yielded deflections not differing more than approximately $\frac{1}{4}$ in. for a given beam. Therefore, the choice of assumptions is not too critical a problem. In general, deflections computed under the first set of assumptions gave center of span elevations equal to or higher than elevations derived from the other assumptions. In order to insure that mid span slab thicknesses will be adequate, it is best to assume the highest elevations that may occur

in the center of the span. Therefore, the first set of assumptions seems to be the most logical to adopt.

It is hoped that this article will accomplish three purposes—help designers in setting up prestressed beam calculations, show them short-cuts in arriving at the final answers, and, of most importance, stimulate an inquiry into the basic theory of plastic flow and the other unsettled questions vital to prestressed concrete design.

Bibliography

1. *Criteria for Prestressed Concrete Bridges*, U. S. Department of Commerce, Bureau of Public Roads, Washington, D. C. 1955.
2. Lin, T. Y., *Design of Prestressed Concrete Structures*, John Wiley & Sons, Inc., New York, New York, 1955.
3. *Prestressed Concrete Bridge Calculations Illustrate Use of Design Criteria*, Portland Cement Association, Chicago, Ill.
4. *Report on 70 Ft. Beam Test for Concrete Products Company of America*, Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa., Sept. 1, 1956.
5. *1956 Concrete Industries Yearbook, Part III, Prestressed Concrete*, Pit and Quarry Publications, Inc., 431 S. Dearborn St., Chicago, Illinois.
6. Bankston, Carl L., Jr., *Unique Properties and Cost Advantages Promote Prestressed Concrete Design*, Consulting Engineer, Feb. 1957, Consulting Engineer Publishing Co., 227 Wayne St., St. Joseph, Michigan.
7. *Bulletin D6-Concrete Stress Distribution in Ultimate Strength Design*, Portland Cement Association, Chicago, Illinois.
8. *Alpha Composite Construction Engineering Handbook*, Porete Manufacturing Company, North Arlington, New Jersey.

RIVER CROSSING OF WATER SUPPLY MAIN USES TWO COFFERDAM INSTALLATIONS

THE CITY OF Reading, Pa., recently enlarged its water supply facilities by installing nearly a mile of Armco steel water pipe. The 30-

inch pipe was supplied in lengths of 50 feet and joined with Dresser couplings. Of special interest was the Schuylkill River crossing, which

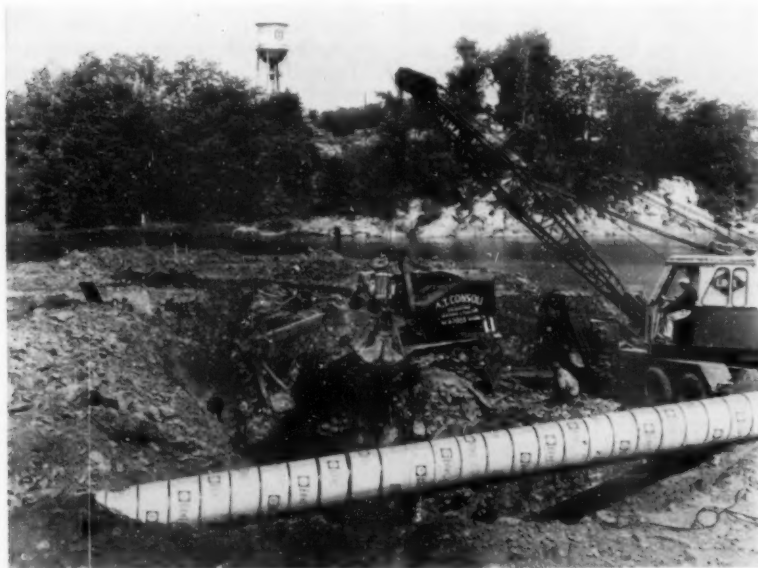
was accomplished by building a cofferdam halfway across the river, excavating a trench in the cofferdam and installing the steel pipe. After the pipe had been laid halfway across, a second cofferdam was built from the opposite shore and the rest of the pipe installed.

The contractor for the water line job was J. A. Hess & W. A. Hess, Inc., of Hazleton. Gilbert Associates of Reading was the engineer.

• • •

Long Beach Plans Marina

Scheduled for completion in 1961 by Long Beach, Calif., is a marina which will provide 1,800 berths for small vessels. In addition to the boat berthing facilities, there will be parking facilities for more than 2,700 automobiles, roads, boat and ship repair yards, a fire boat station, a restaurant, a store supplying marine hardware and comfort stations. Total cost when completed will approximate \$14 million. A charge of about 85 cents per month per foot length of vessel will be made for berthing.



● CRANE and backhoe team up to excavate a trench in a filled cofferdam built halfway across the Schuylkill River. The new water main will serve Reading, Pa.

WATERWORKS MOVE TOWARD AUTOMATION

LEO G. SANDS

ONE of America's oldest cities, Philadelphia, is far from being behind the times. One of the first to install computer control of its traffic signals, Philadelphia is now automating its waterworks operations. While it is not complete automation, it is a big step in that direction. Installation is being made of an elaborate electronic system that will automatically transmit information from 94 points in the city's water system to 8 key locations. The new system will provide complete operating information instantly which will enable better control of the far-flung water system and at lower cost. Electronics is replacing the old system which involved many human beings using telephones.

While the Philadelphia water system's first step toward automation represents an investment of \$432,000, smaller communities can also make moves in this direction at comparably smaller cost.

Telemetry

Telemetry, the art of transmitting information from one point to another, can be employed to provide remote visual or printed information on such important items as the level of water in storage tanks, basins and reservoirs as well as pumping rates and pumping pressures. Information on pressures in various parts of a system can be readily transmitted. All of the information needed to maintain supervision and control of a water system can be transmitted electronically from any number of points to one or more central points.

Mr. Sands is a consultant on communications systems and controls. His technical writing has resulted in many magazine articles and several books, including *Marine Electronics Handbook*, published by Howard W. Sams Co. and Dobbs-Merrill. He is the author, also, of "New Jersey Turnpike Utilizes Electronics for Traffic Surveillance" appearing in *PUBLIC WORKS* in March, 1959.

This information may be transmitted over private wire lines or leased telephone circuits, or it may be superimposed on power lines. The data can also be transmitted by UHF or microwave radio. When wires are used, individual wires could of course be used for each type of information, but today there are many electronic devices available which will permit transmission of many different kinds of data or both.

A measurement is sensed by a device which converts a physical condition into electrical form, as a voltage. Once the information has been so converted, it can be transmitted easily. These devices are commonly called *transducers*. Transmission may be continuous, at regular intervals or only when the information is asked for. For example, an ordinary telephone dial or push buttons can be used at a central location for interrogating remote points.

Remote Control

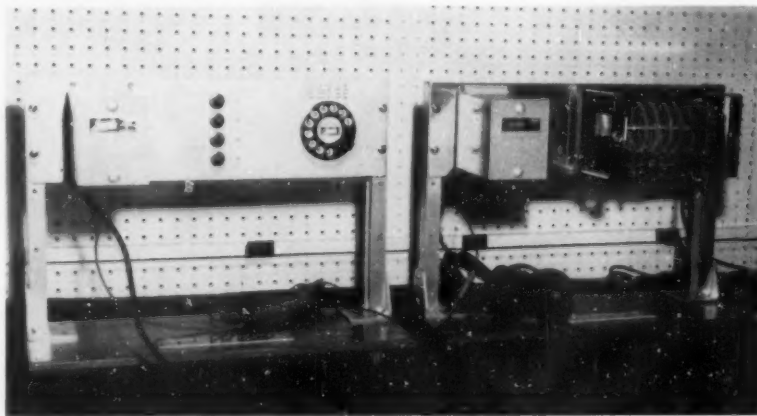
In addition to telemetry, remote control or remote supervisory control can be provided readily. *Remote Control* implies that commands are issued at one point and are carried out at another but without

provision for return signals. When *supervisory control* is provided, return signals are transmitted back to the control point indicating whether the commands have been obeyed.

D-C System

The simplest form of system conveys yes or no answers. As illustrated in Fig. 1, a pair of sensors may be installed in a tank or reservoir for indicating whether the water level is normal or too low. When sensor A is immersed, it closes an electrical circuit to ground which turns on lamp A at the control center. When sensor B is immersed, the signal light for B will glow. The sensor may be a float-operated switch, a thermistor (a resistor in which the resistance varies with temperature changes) or an ultrasonic device.

The transmitter may be a tone generator, as shown in Fig. 2, whose signal is intercepted at the far end by a tone receiver tuned to the same frequency. By using different tones for A and B, the two signals can be transmitted over the same wire line without conflict. Equipment is now available which permits simultaneous transmission of about 18 tones over a single wire pair or radio voice channel which will pass voice



Courtesy Seecode Corporation

● TWO ENDS of a remote control system. Commands are issued with a telephone dial. Unit at right, which may be miles away, responds to the control unit.

frequencies up to 3000 cps. If the wire line or radio circuit will pass a wider band of frequencies, the number of tone channels can be increased.

The tone transmitters are essentially low-power, low-frequency radio code transmitters, each broadcasting on a different frequency. The tones are picked up at the other end by simple low-frequency radio receivers, each tuned to pick up the frequency of its associated transmitter. This is a one-way system.

In a two-way system it is possible to receive information from a remote location and to take corrective action at the control point. Fig. 3 illustrates a simple system of this type. To the system shown in Fig. 2, two transmitters and one receiver have been added at the central location and two receivers and one transmitter have been added at the remote point. Channels A and B transmit information on water level to the central point. When the push button for channel C is operated, transmitter C sends a tone that is picked up by receiver C which trips the magnetic starter of the pump motor. This also causes transmitter E at the pump location to send a signal back to receiver E at the central point, which turns on a lamp to indicate that the pump is running. When the other push button is pressed, transmitter D sends a tone to receiver D which releases the magnetic pump motor control, shutting off the motor. This also shuts off transmitter E, cutting off the tone from receiver E, and turning off the "pump on" lamp. This is a simple yes-no telemetering and remote supervisory control system.

More complete information may be transmitted than a simple yes or no. It is possible to transmit continuously variable or incremental data by employing transducers that yield a quantitative output and transmitters whose output signal is varied in a manner to provide graduated information.

A system can consist of many transmitters and receivers, some carrying yes-no information, some carrying quantitative information and some conveying control commands. The control of pumps and valves may be executed at their locations by providing suitable controls so that they will function automatically unless ordered to do otherwise by a signal from a central point.

Dial-Type Interrogation

In an interrogator system, as shown in Fig. 4, a dial may be used

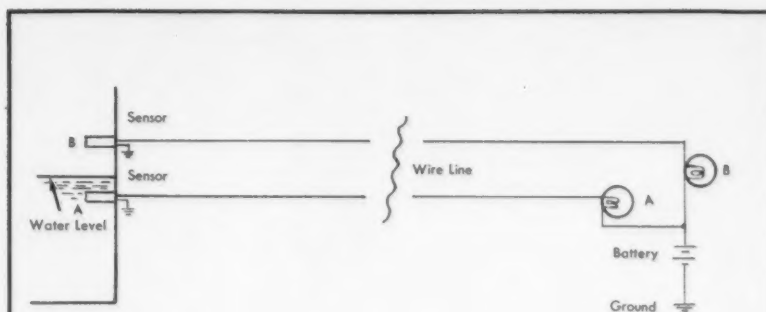


FIG. 1

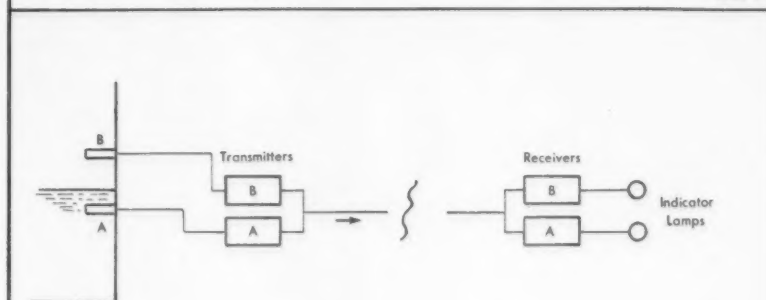


FIG. 2

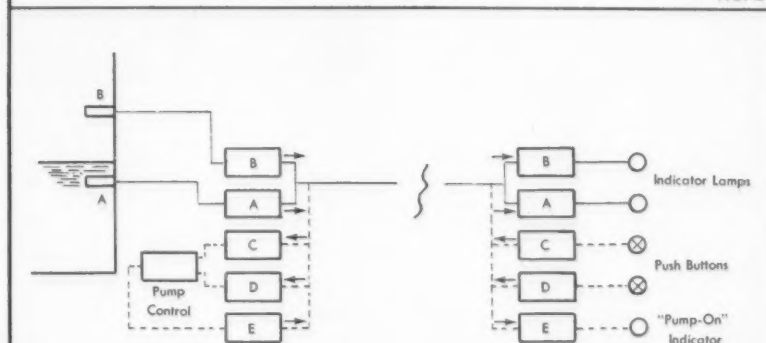


FIG. 3

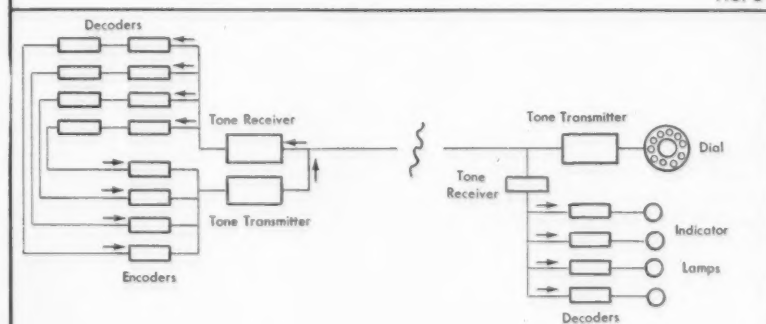


FIG. 4

● VARIATIONS of telemetering circuitry using line transmission of signals and commands. A simple battery-powered signal system indicates two conditions of water level in Figure 1. Tone transmitters and receivers may be used to convey the same or pump on-off information as in Figure 2. By adding more components, supervisory control is achieved in Figure 3. Figure 4 shows a dial interrogator system using decoders and encoders permitting the translation of an unlimited number of commands.

at a central point for control or interrogation of motors, valves and transducers at a remote location. When the dial is operated, pulsed tones are transmitted which actuate all of the decoders at the remote end of the line; but a pair of electrical contacts in only the one decoder whose number was dialed will close. The closing of the contacts may be used to start or stop apparatus or to interrogate a transducer. When the function has been carried out, the encoder (an electronic or electro-mechanical dial pulse code sender) associated with it is actuated. The encoder pulses the output of the remote tone transmitter which sends out a coded tone to the decoders at the central location. Here, the decoder whose dial code was transmitted back closes its contacts and lights an indicator lamp. The outbound tone transmitter and receiver operate on one frequency, the inbound tone is on another frequency.

Such a system can also be arranged so that the encoders will be activated automatically to transmit a warning signal back to the central location in the event of false operation or a change in level or pressure beyond certain limits.

On the same line, other continuous or coded tone transmitters and receivers can be operated for transmission of information, without interfering with the dial-controlled interrogation and control functions of the system.

A dial system has the advantage that a single tone channel (transmitter and receiver) can be used for the transmission of an infinite number of commands. There are dial-pulse actuated decoders, such as those made by Secode Corp., that can be set to respond to 4 or more different codes, chosen from among 20 million different numbers. For all practical purposes, the capacity of a dial system is infinite, since one tone channel can convey almost limitless information. Imagine the capacity of such a system when a dozen different tone channels are transmitted over the same line, each handling its own dial control system.

Tone Transmitters

There are many kinds of tone transmitters and receivers, most of which operate on frequencies within the voice range. The frequency is customarily limited to the 300-3000 cps (sometimes up to 3500 cps) range, because that is the acceptance limit of a typical voice circuit, whether a leased telephone line, a carrier-derived telephone channel



● **BIG EQUIPMENT:** Microwave antenna on roof of building is adjusted so that its beam will be aimed directly at the next station or link in the UHF system.

or a voice channel of a UHF or microwave radio system.

Westinghouse, for example, recently introduced its line of KA tone units that employ transistors in lieu of tubes. They enable the transmission of 18 different tone frequencies over a single voice wire (on a pair of wires) or a radio circuit with frequencies ranging from 425 cps to 3315 cps. They are available in AM types (on-off keying), FM types (frequency-shift keying) and voltage-keyed types which yield a 15-35 cps variable a-c output for driving a meter or other type of indicator.

Radio Frequency Laboratories, Inc., the firm which was awarded the contract to furnish the telemetering equipment for the Philadelphia water system, manufactures telemeter terminals which accept variations in a small d-c voltage and yield a variable pulsed d-c output. The d-c input signal is converted to low frequency a-c which modulates the audio tone carrier. At the receiving end the demodulated low frequency a-c intelligence is converted into pulsed d-c. Changes in input signal cause like changes in

the output signal, with an accuracy of one percent.

There are many other manufacturers of tone transmitters and receivers including Lenkurt Electric, Tele-Dynamics, Motorola, Lynch Carrier Systems, Hammarlund, Secode and Northern Radio. Telegraph carrier equipment can be used for this purpose. It is available in both AM and FM types, some operable at speeds up to the equivalent of 100 telegraphed words per minute.

In AM keying, the tone is turned on and off by the actuating device. The tone generator may be turned on continuously, interrupted by the actuating device. Or the tone may be normally off, being turned on when a signal is to be sent. The tone may be keyed on and off rapidly, as with a telephone dial to transmit a variety of information, or it may be employed simply to perform a yes-no function. At the receiver, a relay is caused to open and close in response to the tone on-off conditions.

In FM keying, the tone generator operates at all times. Normally, the tone is transmitted on one frequency. When actuated, the tone is

shifted to a different frequency. The receiver is sensitive to frequency changes and actuates a relay when the tone shifts from one frequency to the other. Like AM types, frequency-shift tones may be used for yes-no functions or may be keyed rapidly for transmitting coded information.

The modulated type of tone system is responsive to continuous or incremental changes in voltage at one end which modulate the tone over a narrow range. If wide-band modulation were employed, each tone channel would consume more space and the number of tone channels that could be derived for transmission over a single voice circuit would be limited. Actually, the tone transmitter sends out an AM signal which is demodulated at the receiver where it is translated into a varying voltage that can be used to drive an indicating or variable control device.

The AM (on-off) tone system can be likened to blinking of a light while the FM (frequency-shift) type is comparable to using two lamps, each of a different color, for transmitting intelligence. The modulated type is more complex and is comparable to varying the brilliance of a lamp to convey quantitative information.

Transmission Media

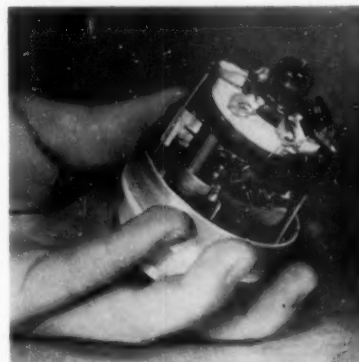
An ordinary telephone circuit is capable of handling the tones used in typical telemetering and control systems. When radio is used as the transmission medium, two radio systems combined into a single system are required if information is to be transmitted in two directions simultaneously since a two-way radio link is comparable to a four-wire telephone circuit, one pair for each direction of transmission. See Figs. 5 and 6.

A UHF or microwave radio link is capable of handling far more information than is required for waterworks control and telemetering purposes. The relatively inexpensive "thin-route" microwave systems, which can handle up to four or six voice circuits simultaneously, can be used for carrying up to 18 tone channels in place of one of the voice channels. While it would seem that all of the voice channels could be multiplexed for carrying up to 18 tone channels each, experience shows that noise and crosstalk problems are apt to crop up. While there is no problem in transmitting as many as 240 voice channels over a 240-channel microwave system, the transmission of keyed tones is more

difficult. This is because the voice signals are of lower average level than the tones and vary rapidly in level and frequency and over a wide range, seldom building up to a high total amount of energy at any one time. However, the requirements of even a large water system are relatively small and the problems are far from insurmountable by the communications engineer planning the radio link system.

Whether to use radio or wires is more of an economic question than one of performance. It can be costly to lease a network of telephone wires. Under typical tariff arrangements, individual rather than party-lines have to be leased. On a mileage basis, the charges can come high. Also, the lease rate may be determined by the use of the line, being one figure for transmission of one tone, and higher when more tones are to be transmitted.

But, a radio system is not inexpensive. To install a microwave station at each of ten remote points and at one central point could entail an investment of from \$25,000 to \$200,000 depending upon many local factors. However, once the microwave system is in, the municipality



Courtesy Donner Scientific Co.

● **SMALL EQUIPMENT:** An electromechanical transducer, which translates force into electrical impulse.

concerned will have at its disposal a very broad communications expressway which can be used for transporting a tremendous amount of information. The radio system can be used as the backbone of a private telephone system. Teletypewriter communication can be provided. The community's police, fire and public works mobile radio systems can be controlled over the microwave system. Even computers can be linked together without wires between the major locations.

Where suitable electric power lines are available, which are routed

so that they interconnect the desired points, it may be possible to superimpose power line carrier equipment on them, enabling the transmission of tones and a voice channel or two. Where it is feasible, a communications overhead wire line or underground cable can be constructed which will convey not only the tones but several telephone circuits by utilizing telephone carrier equipment.

Microwave Systems

When a microwave system is used to link the load control center or water department headquarters with other waterworks facilities, the radio stations must be licensed by the Federal Communications Commission and must be maintained by FCC licensed personnel. The equipment can be furnished in duplicate so that service continuity will be maintained, one set of microwave equipment at each station being in use normally, the other automatically switched in if an equipment failure occurs.

Fig. 7 shows what is known as a loop microwave system which does not require duplicate equipment. The radio signal is routed from headquarters to station A where it is relayed to B which relays it to C. The microwave repeater at C relays the intelligence to D which relays it to headquarters. If the equipment at B, for example, should fail, information from A to C would automatically be routed via the headquarters station and repeater station D.

The more conventional approach is shown in Fig. 8. The radio stations at headquarters A and D are microwave terminals. At C a microwave repeater is used. At B a three-way junction station is used. Intelligence may be injected and tapped off at all stations. In this kind of system standby microwave equipment is often used. There is what is known as *cold standby* in which the reserve equipment is kept turned off until automatically turned on in event of equipment failure, resulting in a small delay. When *hot standby* is used, the reserve equipment is left turned on but does not transmit until a failure occurs. Or, in some hot standby systems, both sets of equipment are active, one transmitting a horizontally polarized radio wave, the other transmitting a vertically polarized wave. The radio system functions when either or both signals are transmitted. Still another approach is *diversity standby* in which both systems transmit simultaneously.

When microwave is used, line-of-sight conditions must prevail between each pair of stations. In Fig. 8, one must be able to see the antenna of station B from the antenna of station A, and so on. However, when the distance is very short, it may not be necessary to have line-of-sight conditions if the signal can reach one station to the other by being reflected by solid surfaces.

Since the distances involved in a typical water system are usually quite short, except perhaps in a city of wide area, such as Los Angeles or Seattle, the microwave antenna supporting structures need not be very high and therefore would not be costly. Sometimes, when line-of-sight conditions cannot be obtained because of intervening hills or structures except by using very tall antenna supports, a passive repeater may be used or live repeater may relay the signal from headquarters, for example, to a distant reservoir.

A passive reflector is merely a large flat metal surface which acts like a mirror, reflecting the radio signals from one point to another. The Southern Pacific Railroad uses passive reflectors on the side of Mt. Shasta to bounce a microwave signal around obstructions from Dunsmuir to Black Butte. Seattle's municipally owned electric power system employs passive repeaters on the sides of mountains to get microwave signals in and out of a power generating plant deep in a canyon. In a city, a passive reflector could be mounted on the roof of a suitably located building, hilltop or water storage tank structure.

Sensors

A sensor for detecting water level may be a thermistor. This can be used in a circuit where a drop in its resistance increases current flow through a relay whose contacts actuate a tone transmitter. A float-operated switch could also be used.

An ultrasonic sensor has been developed by Bogue Electric Manufacturing Co., which is expected to become available commercially very soon. The sensor contains two barium titanate crystals, one of which emits an ultrasonic wave which is intercepted by the other, but only when there is liquid between the two crystals. The two crystals are imbedded in Teflon which seals out the water. When there is air in the gap in the Teflon housing between the two crystals, the vibrations of the transmitter crystal do not get to the receiver crystal. But, when there is liquid

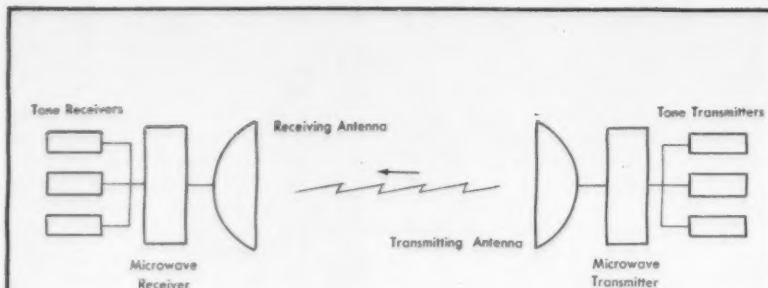


FIG. 5

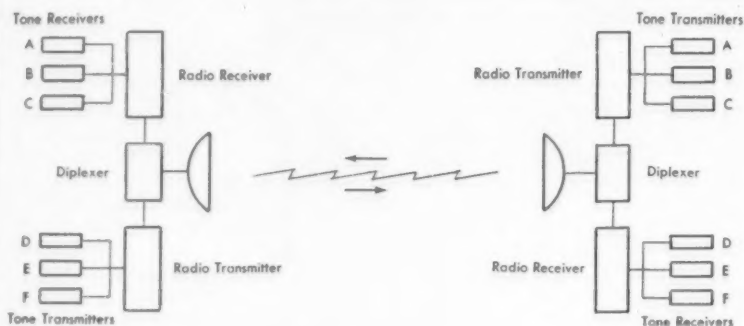


FIG. 6

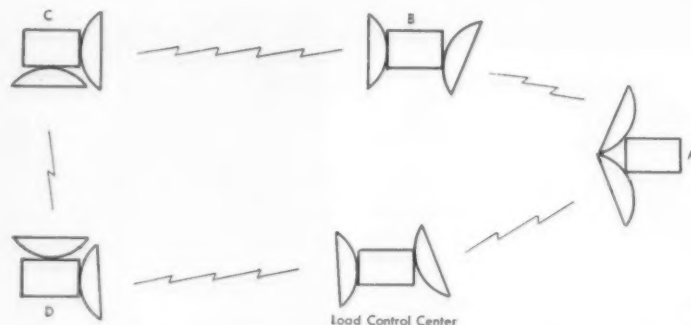


FIG. 7

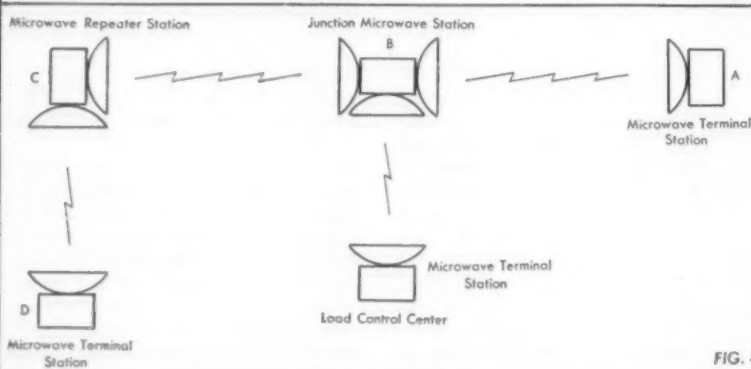


FIG. 8

● MICROWAVE systems of telemetering avoid the use of lengthy wire circuits, but topography must be favorable to line-of-sight placement of antennas for transmitting and receiving signals. Duplication of receiving and transmitting equipment at each terminal converts the one-way radio link in Figure 5 to the two-way system in Figure 6. Microwave transmission and receiving may be looped as shown in Figure 7 for minimizing the outlay of equipment. The conventional application is shown in Figure 8.

in the gap, the ultrasonic waves get through and activate the receiver crystal. The energy picked up by this crystal is fed to an electronic circuit that operates a relay.

A sensor that provides quantitative information, such as pressure, rate of flow or level, may contain a resistance element whose electrical value changes with the physical changes applied to it. The Simmons strain gage, for instance, consists of a piece of resistance wire affixed to a surface. The resistance value changes as stress is applied.

Or, the sensor might be a capacitive type in which the spacing between a diaphragm and a fixed flat surface changes with applied pressure. This causes a change in the electrical capacity between the two surfaces and thus acts like a variable condenser. This technique is used in condenser microphones, commonly used by phonograph recording studios.

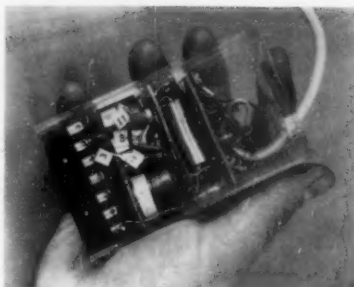
The sensor can be a magnetic device with inductance changes as steady-state or dynamic forces are applied to it. For some applications, the sensor generates an electrical voltage. A rate-of-flow sensor, for example, could employ a small electrical generator whose output voltage or frequency changes with its speed of rotation.

Automatic Interrogation

Moore Associates have developed a data transmission system in which one unit queries up to 8 different points at a remote location at regular intervals. The unit sends out a synchronizing pulse which locks in the unit at the remote location. Then it listens for tone pulses from the remote location. The pulses are normally of the same duration (width in respect to time) when all is normal. However, when one of the points has an off-normal condition, the pulse for that condition is wider and is detected by the unit at the control location. This causes a lamp or other indicator to operate, identifying the point where a change from normal occurred. The system has many other variations and possibilities.

How To Get Started

The techniques involved are beyond the scope of the typical waterworks supervisor. While some may have had electronics experience, the art has made such rapid progress, mainly because of stepped-up military requirements, that specialists should be consulted. S. S. Baxter, head of Philadelphia's water department, consulted 33 manufacturers



Courtesy Western Electric Co.

● **MULTIFREQUENCY** oscillator for data transmission uses transistors.

of electronics equipment in order to find out what techniques would be most applicable and how to prepare a specification that would permit competitive bidding.

The Philadelphia system features microwave transmission and data logging with 10-min. to hourly read-out by electronic typewriters. General Electric Communications Products Division is the prime contractor for the project, furnishing microwave transmission equipment and the supervisory control system. Manning, Maxwell and Moore is supplying primary sensing instruments and transducers. The data logger and scanner is Kybernetes, made by Hagan Chemicals and Controls, Inc., which is also furnishing the main control console. A graphic wall panel is furnished by General Electric. Radio Frequency Laboratories is providing telemeter transmitters and receivers.

There are numerous other firms such as Secode Corp., Syntrol Corp., Tele-Dynamics, Inc., Hammarlund Mfg. Co., Fischer and Porter and Motorola Communications and Industrial Electronics, that specialize in the design and manufacture of complete systems applicable to waterworks applications. These and other similar firms are interested in solving problems for very small as well as large communities.

One way to find out what can be done and how much it will cost is to query several firms, stating what is expected and asking for their recommendations and how they think the problem should be approached. Few, if any, would ask for a fee to make a preliminary survey.

Maintenance

All electronic equipment requires careful maintenance. For some communities, it would be impractical to employ electronics technicians on a full time basis. Fortunately, the use of electronic control devices has expanded so much

that numerous independent industrial electronic servicing organizations have cropped up in all parts of the country. Some offer their services on a monthly contract basis, others charging for services on a time and parts basis. The new Philadelphia installation is being maintained for the first year by General Electric Co., the prime contractor. Their personnel will train city employees. Some firms, like Tele-Dynamics, not only engineer and furnish the equipment for control and telemetering systems, but also provide maintenance service in the middle-Atlantic states around Philadelphia.

Other Possibilities

While in most instances control and information transmission will be required between waterworks facilities at fixed locations, it is possible to extend control to supervisors on cars and trucks. This is done by equipping vehicles with a dial or push-button code sender which transmits signals via mobile radio transmitter to a VHF or UHF radio station tied into the control network. Read-out devices can also be installed on vehicles.

Summary

Philadelphia, of course, is not the first to install electronic control in waterworks operations. Albuquerque, New Mexico, has installed such a system as have several other communities, these systems varying widely in scope and complexity. The Philadelphia installation is significant, however, because it combines a microwave radio relay system with the control and telemetering facilities. From its present 8-station network, it can be expanded in the future in both breadth (channel accommodations) and length. It includes some supervisory control of remote facilities, with additional controls to be added. It is significant, too, because it effects sizable economies.

The electronics art has advanced to the stage that almost any information capable of translation into an electric current can be conveyed with great fidelity to any number of points and can be made available in visual, audible or graphic form. It is also possible to control any machine or device that can be actuated electrically from any distance. The recent developments in space technology have extended man's communicating range to more than 400,000 miles. Electronics makes available tools that will help the water engineer do a better job at less cost to the taxpayers.

DAYBROOK *does it faster .. SAFER!*



FLEET OF 20 DAYBROOK POWER PACKERS SERVING THE FAST-GROWING CITY OF PHOENIX

The City of Phoenix fleet of 36 refuse collection trucks includes 20 Daybrook Continuous Loading Power Packers. Since the first Daybrook Power Packer unit was put into route service in Phoenix over a year ago, these Daybrook features of operation have proven most popular:

- **FASTER ROUTE COLLECTIONS**
- **GREATER COMPACTION . . .
LONGER ROUTES**
- **GREATER OPERATING
EFFICIENCY**
- **GREATER SAFETY**
- **LOWER MAINTENANCE**

Daybrook Power Packers are used on two types of collections

—curb pickups and alley collections. There are 85 routes in the city averaging from 850 to 900 homes each.

Daybrook Power Packer operation is safer because there are no dangerous shearing actions—no chains or gears to catch clothing.

Your city or community, large or small, can handle refuse collection requirements faster and safer with the use of Daybrook Continuous Loading Power Packers. Also, commercial and industrial collections can be handled faster and safer with the full hydraulic Sani-Tainer Method, utilizing 1, 2 and 3 yard containers. Ask for a demonstration on your own routes.

Daybrook—manufacturer of a full line of truck equipment for cities, counties, state and federal governments—

- Aluminum and Steel
- **DUMP BODIES**
- Underbody and Telescopic
- **HYDRAULIC HOISTS**
- **POWER GATE®**
(hydraulic end gate)
- **POWER LOADER**
(hydraulic crane for trucks)
- **POWER PACKER**
(refuse collection body)

Write for free literature



**DAYBROOK HYDRAULIC DIVISION
BOWLING GREEN • OHIO**



NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Manual of Street Cleaning Practice Now Available

Chicago, Ill.—The first revision of *Street Cleaning Practice*, published originally in 1938, is now available. The 424-page cloth bound book, prepared under the direction of the Street Sanitation Committee of the American Public Works Association, has been published by the Public Administration Service. The book, a practical manual on the municipal street cleaning problem, contains numerous photographs, charts and tablets, an extensive index, selected bibliography, typical ordinances and tabulations of street cleaning practices in 100 cities. It includes separate chapters on the general problem, local conditions affecting street cleaning, methods and equipment, planning operations, reducing the amount of street dirt, special problems, catch basin and inlet cleaning, snow and ice control and removal, organization, personnel, equipment management and street cleaning budgets, records and costs.

The Street Sanitation Committee was formed early in 1956. A comprehensive survey of street cleaning practices in the U. S. and Canadian cities was conducted soon thereafter and the information obtained provided much of the data upon which the revision is based. The Committee found that although the basic principles of street cleaning outlined in the earlier edition remained basically the same, important changes in conditions have occurred. "...

The most significant has been the ever-increasing cost of labor, which has resulted in greater mechanization of street cleaning and snow removal operations." Labor and personnel problems were found to have become increasingly important, "both because of high labor costs and because of the increase in unionization of municipal employees." The Committee's study also confirmed that "during the past few years, there has been a great increase in litter prevention efforts on the part of governmental agencies and private groups in a determined attempt to reduce public littering, and thus, the street cleaning problem."

Also included in the revised manual are data gathered in special studies by sub-committees on rock salt specifications and litter baskets.

The Street Sanitation Committee of the APWA consists of Paul R. Screvane, *Chairman*, Commissioner, Department of Sanitation, New York, New York; D. A. Andersen, *Assistant City Engineer*, Department of Engineering, Seattle, Washington; James A. Brophy, *Street Commissioner*, Division of Streets, Sewers & Sanitation, Madison, Wisconsin; John E. Cassreino, Sr., *Director*, Department of Sanitation, New Orleans, Louisiana; Hugo G. Erickson, *formerly City Engineer*, Minneapolis, Minnesota; James F. Martinek, *Director of Public Works and City Engineer*, Riverside, California; Murphy U. Snoderly, *Secretary*, Consultant, Municipal Technical Advisory Service, University of Ten-

nessee, Knoxville, Tennessee; and James J. Sullivan, *City Engineer and Superintendent*, Department of Streets and Engineering, Springfield, Massachusetts.

The committee was assisted by Richard Fenton, *Assistant to the Director of Operations in the New York City Department of Sanitation*.

Non-members of the APWA should purchase *Street Cleaning Practice* from the Publisher, Public Administration Service, 1313 East 60th Street, Chicago 37, Illinois, price \$7.00 per copy. Distribution of the book to members of APWA will be handled by the APWA headquarters office. The APWA has made a bulk purchase of the books thereby permitting the Association to make the book available to its members for \$5.00 per copy.

W. Fred Welsch Receives Sanitation Honor Award

Chicago, Ill.—W. Fred Welsch, *Senior Hydraulic Engineer*, Nassau County, N. Y., Department of Public Works, has been selected to receive the 1959 Charles Walter Nichols Award of the American Public Works Association. Welsch was cited "for his pioneering and sustained leadership in the development and administration of a program of artificial recharge of ground water with storm water in New York's Nassau County, thereby conserving the area's vital water supply and preventing the intrusion of salt water into the underlying aquifer; and for his technological contribu-

OFFICERS: Jean L. Vincenz, San Diego, Calif., *President*; Frederick W. Crane, Buffalo, N. Y., *Vice President*. REGIONAL DIRECTORS: (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Texas; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore.; (term ending 1962) Paul R. Screvane, New York, N. Y.; Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D. *Immediate Past President*, Wm. D. Hurst, Winnipeg, Manitoba. Robert D. Bugher, *Exec. Director*.

Fast, Low-Cost Ice Control



You eliminate treacherous ice from your streets and provide safe protection for your winter-time traffic **FASTER** and **CHEAPER** with straight de-icing salts. The TARCO "Scotchman" is **especially designed** for the correct application of these granular or pelleted materials.

This "Jeep" mounted "Scotchman" uses the 1 cu. yd. "Watchman" Hopper. Here's enough salt to cover more than 5 miles of pavement, 30 feet wide. One man operation. Gasoline engine driven or operated from P.T.O. The "Scotchman" spreader has been **job-tested over 10 years** by cities, state highway departments, and industrial plants.

For **emergency ice control** of busy intersections, hills and bridges this "Jeep" mounted "Watchman" Hopper and one man operated "Scotchman" spreader will save you a lot of time and material, and needless traffic tie-ups. See your nearest Tarco dealer . . . or write to us.

TARRANT MFG. COMPANY

28 Jumel Place, Saratoga Springs, N.Y.

4



Facts about IGAS JOINT SEALER

- 1 . . . **VERSATILITY:** This tough, non-meltable black or gray compound will adhere to any construction material in vertical, horizontal and overhead joints.
- 2 . . . **STABILITY:** Igas remains flexible over a wide temperature range. It will not sag or flow in hot weather. It will not become brittle in cold weather.
- 3 . . . **DURABILITY:** Even after years of exposure, Igas will not lose its effectiveness. Containing no solvent, it will not dry out nor shrink.
- 4 . . . **RESISTANCE:** Igas resists sewage, salts, non-oxidizing acids, dilute acids and sea water. It is non-toxic.

For all the facts, write for Bulletin IS-59



SIKA CHEMICAL CORPORATION

MAIN OFFICES: Passaic, N.J.; Distributors and dealers in principal cities; Affiliates around the world.

tion to the science of ground water conservation at a time when this problem is of growing importance throughout the nation and when his work may encourage other water-short communities to attempt similar procedures."

The Nichols Award is made each year by the APWA to a municipal public works official who has been responsible for an operation or de-



W. Fred Welsch

sign which reveals "originality of thought and aggressiveness of execution by the candidate." The ideas developed or designed must have been put to practical use within the governmental unit in which the candidate is employed and the candidate must not have received any commercial return for his achievement.

Formal presentation of the award, which includes a certificate describing the achievement and an honorarium of \$500 was made September 23 at the annual dinner of the 1959 Public Works Congress and Equipment Show held in Seattle, Washington.

Welsch, who is a graduate of Cooper Union and a Registered Professional Engineer and Land Surveyor in New York State, has been with the Nassau County Department of Public Works since 1938. His responsibilities include administering the County water survey programs and serving as Department liaison between local officials of the county's 50 public water supply systems.

University of California Student Wins Education Award

Chicago, Ill.—Leonard W. Chapman, Walnut Creek, California, has won the \$1,000 1959 Engineering News - Record Aid - to - Education Award. Chapman, who won the Award against nationwide competition, will complete his studies for a Master of Science degree in municipal engineering at the University of California in 1960. The Award, endowed by the *Engineering News-Record*, is administered by the APWA. It is awarded annually to an undergraduate senior or graduate student who wishes to prepare

P&K

street and highway LIGHTING STANDARDS



FOR EVERY JOB APPLICATION

P & K all-aluminum standards are available in such a wide range of styles, sizes, and heights, that they offer virtually unlimited architectural design possibilities. They meet all requirements for strength and durability, and, most important, provide a basic beauty matched by no other material.

WITH UNIQUE ADVANTAGES

In addition to the strength, light weight and corrosion resistance inherent in aluminum, P & K has provided several exclusive features of its own: for instance, P & K's tapered elliptical one-piece arm design means a minimum inventory of parts, P & K features rivnut mounting to speed installation, P & K's one-piece base welded to the shaft means no expensive field assembly, and many more. The sum total add up to faster installation at lower cost.

MAKES LIGHTING DOLLARS GO FURTHER

With such a wide range of styles to choose from, backed by extensive production facilities, you can select standard units that will exactly meet your specifications. And for savings that go far beyond the original cost, consider this: P & K aluminum standards never need painting or other costly maintenance.

PFAFF & KENDALL
84 FOUNDRY ST., NEWARK 5, NEW JERSEY

There's a wealth of helpful information available. Use this convenient coupon.

- | | |
|---|---|
| <input type="checkbox"/> ALS—all-aluminum lighting standards | <input type="checkbox"/> LTG-30—describing CIRCLElux luminaires |
| <input type="checkbox"/> BR-11—all-aluminum lighting brackets for wood, steel or concrete pole mounting | <input type="checkbox"/> ALS-40—describing davit-style lighting standards |
| <input type="checkbox"/> ALS-59—describing aluminum conversion units | |

NAME

COMPANY

ADDRESS

CITY ZONE STATE



**Superior Design,
Construction and
PERFORMANCE**

far greater
strength and
SAFETY!

AMERICAN
Approved
**PLAYGROUND
AND SWIMMING
POOL EQUIPMENT**

The wise choice of experienced
buyers for nearly half a century.

WRITE FOR LITERATURE

AMERICAN
PLAYGROUND DEVICE CO.
ANDERSON, INDIANA, U. S. A.
WORLD'S LARGEST MANUFACTURERS OF FINE
PARK, PICNIC, PLAYGROUND, SWIMMING
POOL AND DRESSING ROOM EQUIPMENT

Stop!
Costly Bird
Damage
WITH
Bur-Co
BIRD REPELLENT



**Bur-Co POSITIVELY MAKES
BIRDS AVOID ANY BUILDING
— BUT CANNOT HARM THEM**

Does away with unsightly—and damaging—bird droppings. One application is guaranteed to last for a year—some have lasted over four years.

Bur-Co is easy to apply and will pay for itself many times over in eliminating costly cleaning and repairs. Not harmful to humans... does not damage buildings.

A few of the countless who keep their buildings attractive with Bur-Co: Mayo Clinic, Remington Rand, Monsanto Chemical, DuPont, Chrysler Corp., and RCA.

WRITE DEPT A-5 FOR LITERATURE—TODAY

BUR-CO
BIRD REPELLENT

Burr
CHEMICAL COMPANY
3329 AUBURN STREET
ROCKFORD, ILLINOIS

himself for a career in the field of public works.

Chapman, who is 27 years old, was born in New York City and attended New York schools. He graduated *cum laude* from Williams College, Massachusetts, with a Bachelor of Arts degree in 1953. He moved to California in 1954 and served as an Electronic Maintenance and Operations Officer in the U. S. Navy from



John Morin (right) presents certificate to Leonard Chapman, winner of the 1959 ENR Aid-to-Education Award.

1954-1957. He has been employed by the city of Hayward, California as a Junior Civil Engineer. Active in student organizations, Chapman is president of the U. C. Cooperative Engineers and vice president of Tau Beta Pi, national honorary engineering fraternity.

William Henderson Honored for Service to American Public Works Association

Chicago, Ill.—William Henderson, retired Superintendent of Gas Distribution for the Los Angeles Gas and Southern California Gas Company, has been cited by the American Public Works Association for his leading role in the establishment of the Association's Southern California Chapter.

Mr. Henderson, who now resides at 7312 East Country Club Road, Downey, California, served as President of the Southern California Chapter of the APWA for an unprecedented 5 consecutive terms subsequent to his "formal" retirement in 1950. The Southern California Chapter is the second largest of the APWA and has gained considerable recognition in its area as well as nationally through its many contributions to the public works field. The most recent is preparation and publication of a model street excavation ordinance by the Chapter's Committee on Uniform Ordinances.

The award, called the Harry S. Swearingen Award, was established in honor of the late Harry S. Swearingen, Principal Real Estate Agent for the Los Angeles Department of Public Works. It consists of an inscribed bronze medal mounted for desk display.

N.Y.-N.J. Metropolitan Chapter Meets at Jersey City

Over 440 members and guests registered at the Fall Meeting of the New York-New Jersey Metropolitan Chapter, held in September at Jersey City, N. J. Host was the Jersey City Incinerator Authority, with Authority Chairman Frank H. Tuohy acting as meeting chairman.

Throughout the morning registrants inspected the Authority's new incinerator plant and a variety of exhibits of equipment and materials displayed at the plant grounds. Luncheon was served at nearby Roosevelt Municipal Stadium through the courtesy of several manufacturers and local distributors. Following addresses of welcome by Mr. Tuohy and August W. Heckman, Director of Public Works for Jersey City, a brief description of the Incinerator Authority (the only one of its kinds in New Jersey) was presented by Harold F. Steidel, Executive Director of the Authority, and a description of the Incinerator Plant by Francis J. Lynch, Plant Superintendent.

During the afternoon tours covered behind-the-scenes operations of Roosevelt Stadium; demonstrations at the Jersey City Fire Training School; and an inspection of the city's West Side Sewage Treatment Plant.

New Officers for 1959-1960 installed at the dinner meeting of the Chapter are: Floyd Wilcox, Supt. of Public Works, Lynbrook, N. Y., President; Arthur T. Brokaw, City Engineer, Princeton, N. J., Vice President; and William Holster, City Engineer, Clifton, N. J., Board Member. Francis T. Griffin, Village Engineer, Larchmont, N. Y., becomes senior Board Member; and Elroy Spitzer, Engineering Editor, "The American City," and John Baffa, Consulting Engineer, New York, N. Y., were re-elected Secretary and Treasurer, respectively. August E. Zentgraf, Chief Engineer, Dept. of Public Works, Newark, N. J., is immediate past president.

Recipient of the award presented annually to a member who has made outstanding contribution to the Metropolitan Chapter was Ray Murphy, City Engineer of Rye, N. Y., a former president and staunch friend of the chapter.

REFUSE STUDY PROGRAM: Characteristics and Quantity

In connection with a study now being made of the characteristics of refuse, sample collections were made from individual households throughout a homogenous area within a community. The study, sponsored by the National Institute of Health for the American Public Works Association, is being carried on at Purdue University. In a paper at the recent APWA convention, Prof. D. E. Bloodgood, in charge of the work, reported on these studies.

The purpose in making the special house-to-house collections was to determine variations in quantity and quality of refuse. In carrying out this procedure the refuse from every tenth household in an area containing approximately 450 homes was collected and analyzed. The collections were made early in the morning by a truck carrying a sufficient number of containers to permit individual storage of the refuse from each household. A total of 15 sampling operations were conducted and altogether 654 separate refuse collections from individual households were made. The refuse collected amounted to 9,669 pounds and it was produced by 2,260 persons as determined by a census of each household sampled. The refuse collected from the individual households was separated into six categories: paper, grass, garbage, metal, glass, and ashes. The weight and volume of the refuse samples from each household was determined and then converted to a pounds per capita per day and cubic feet per capita per day basis, respectively. A statistical analysis of the quantity of the refuse from individual households was then made to obtain the accuracy of this particular method of sampling.

Composition of Refuse

The percentage composition of the refuse was found to be affected by the season, but average figures were as follows: By weight, paper 44.9 percent; garbage 26.4 percent; metal 13.3 percent; glass 13.2 percent; and ashes 2.2 percent. By volume, the percentages were, paper 74.2; garbage 7.0; metal 13.1; glass 4.8; and ashes 0.9. The bulk density was 6.58 pounds per cubic foot; collections amounted to 1.32 pounds per capita per day or 4.22 pounds per household. Per person, the volume

of refuse was 0.204 cu. ft. per day.

A further study was undertaken to determine the reliability of refuse sampling methods. The procedure followed required the quartering of a large quantity of refuse (1600 pounds or more) and separation of each quarter into the categories of paper, grass, garbage, metal, glass, and ashes. The percentages (by weight and volume) of each category of material in each quarter was determined and compared to the determined composition of the entire mass. Thus it was possible to evaluate statistically the accuracy of sampling only one quarter of a quantity of refuse. The variation from quarter to quarter of the chemical composition of the refuse was also studied. Laboratory analyses included moisture content, ash content, calorific value, carbon, hydrogen, and lipids. Studies were initiated in January, 1958, by Chicago where experience was gained in the handling and sorting of refuse. This led to a comprehensive study at West Lafayette where the accuracy of sampling only a portion of a truckload of refuse was investigated, as indicated below.

Method of Analysis

A total of eight loads of refuse were analyzed at West Lafayette during April and May 1958. Each load was quartered and separated into various categories. The percent weight, percent volume, and bulk density were determined for each category in each quarter. Various laboratory analyses were performed on samples obtained from the categories of paper, garbage, and ashes in each quarter. It was determined by separation that the paper content of the refuse averaged 62.6 percent by weight and by statistical analysis that there were 95 chances out of 100, in sampling one quarter of a load of refuse, that the true percent weight of paper in the entire load would be 62.6 percent plus or minus 4.31.

An analysis of data obtained by a sampling operation conducted at Baton Rouge, La., substantiated the results obtained at West Lafayette. The results of these two studies indicate that it is feasible to sample only a portion of a truckload of refuse rather than the entire load. The quantity or exact portion to be

sampled will depend on the degree of accuracy desired.

Records were maintained at Chicago and West Lafayette of the labor involved in conducting the sampling operations at each of these cities. It was concluded from an analysis of the available data that 20 to 25 man-hours per ton of refuse sampled will result in satisfactory samples for analysis. This figure includes the labor necessary for the separation of refuse into the several categories and the selection of samples for laboratory analyses. It does not include transit time of samples to the laboratory, time for analysis of the samples, or any office work subsequent to the sampling.

• • •

Calcium Hypochlorite Acts Strangely

An unusual incident was reported in the Preventive Medicine Report of an Air Force base, according to the U. S. Navy Medical News Letter. In the process of adding calcium hypochlorite to the automatic chlorinator at the swimming pool, a paper cup was used as the container for the chemical rather than the hard rubber or plastic cup normally employed for this purpose. The airman involved had filled the paper cup with calcium hypochlorite and was holding it when the cup began to glow and then burst into flames.

In the excitement produced by this unexpected reaction, the flaming cup was inadvertently dropped into a nearby 100-pound drum of calcium hypochlorite, resulting in a fire and explosion, and toxic fumes were liberated from the burning material. Two men were burned and one suffered temporarily from the inhalation of chlorine gas. None of the injuries was serious.

After several experiments to determine the cause of this accident, some facts were determined. By adding small amounts of coffee, cream, and sugar to calcium hypochlorite, a fire and small explosion could be produced. This phenomenon seemed to take place only when some sort of moisture and sugar were present together. Similar results could not be produced when the cup contained sugar, water, or cream alone.

Although the reason for this accident may not be entirely clear, it is obvious that similar mishaps can be avoided if only clean cups made of hard rubber or plastic are used when dealing with calcium hypochlorite. (Apparently from Safety Review, 16:5, July 1959).

THE HIGHWAY AND AIRPORT DIGEST



Prepared by FRANK FORCE, Digest Editor

Control of Trees and Shrubs

Trees and bushes are a source of constant trouble to the highway maintenance man. These facts should be considered in the clearing and planting of trees and shrubs in the right-of-way: 1) Physical intrusion of bushes, tree limbs, etc. inside the shoulder or paving lines; 2) snow storage; 3) obstruction of sight distance on curves, at intersections, in front of signs, etc.; 4) obstruction of drainage of channels; 5) danger of collision with trees large enough to damage a car; and 6) shade-induced icing in winter. All tall growth should be kept at least 10 or 15 ft. away from the travelled way. Trees can be allowed closer to the roadway behind guard rail than in other locations where danger of collision is the only factor to consider. Tree trunks large enough to damage a car colliding with them are usually kept at least 20 to 25 ft. from the roadway unless separated from the paving by ditches or steep cut embankments which a car would not be likely to cross. On such questions as the minimum time of exposure to the sun required to prevent irregular icing, exact set-backs for specific situations, and various other subjects, some tentative conclusions may be stated as follows: 1) No tree cutting for the purpose of removing shade hazards is necessary on the northerly side of generally east-west highways, and little on either side of north-south highways; 2) the situation on the southerly side of east-west highways is worse than you think and requires very careful study of sun angles and shadow density, either when clearing or planting; and 3) evergreens are the worst offenders and require the most attention, with deciduous trees being less of a problem.

"Control of Trees and Shrubs for Ease of Highway Maintenance." By

W. Gordon Hunter, Landscape Architect, Maine State Highway Commission. *Rural Roads*, September-October, 1959.

Design of Flexible Pavements

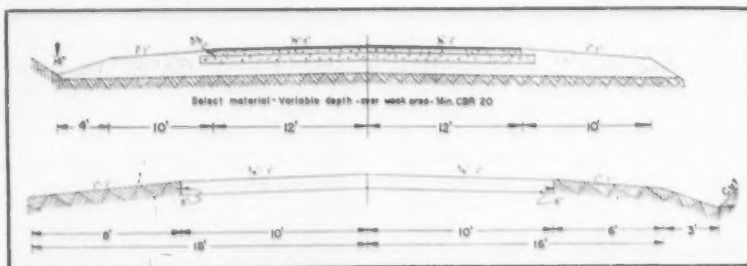
The basic objective in pavement design by the Virginia State Highway Dept. is to build a structure that will transmit the superimposed loads to the underlying strata without permanent distortion and with a minimum of deflection. Preliminary surveys made either on the ground, by aerial photography, or by a combination of both permit the plotting of a continuous roll grade line for use by the soil survey parties. A detailed soil survey is made for every project by an experienced soils engineer, taking as many soil samples for laboratory analysis as is deemed necessary. The California Bearing Ratio Method is selected as most suitable for traffic conditions in the state. The construction specifications require fills and subgrades to be compacted to 95 percent of standard Proctor density. Through design curves and tables, the total thickness of pavement is found and the design engineer must decide the actual depths for each component part of subbase, base and surface. Standard design

for base on the Interstate system is either 5½ or 7½ in. bituminous concrete black base. On the more lightly travelled roads only 3 in. of black base may be specified. Surface courses or wearing courses of all types are utilized. They range from single surface treatments to mixed-in-place, and light penetration treatments on the Secondary System, to asphaltic concrete surfaces on the Primary and Interstate Systems.

"Virginia's Design Program for Flexible Pavements." By A. B. Cornthwaite, Testing Engineer, Virginia Dept. of Highways, *Roads and Streets*, September, 1959.

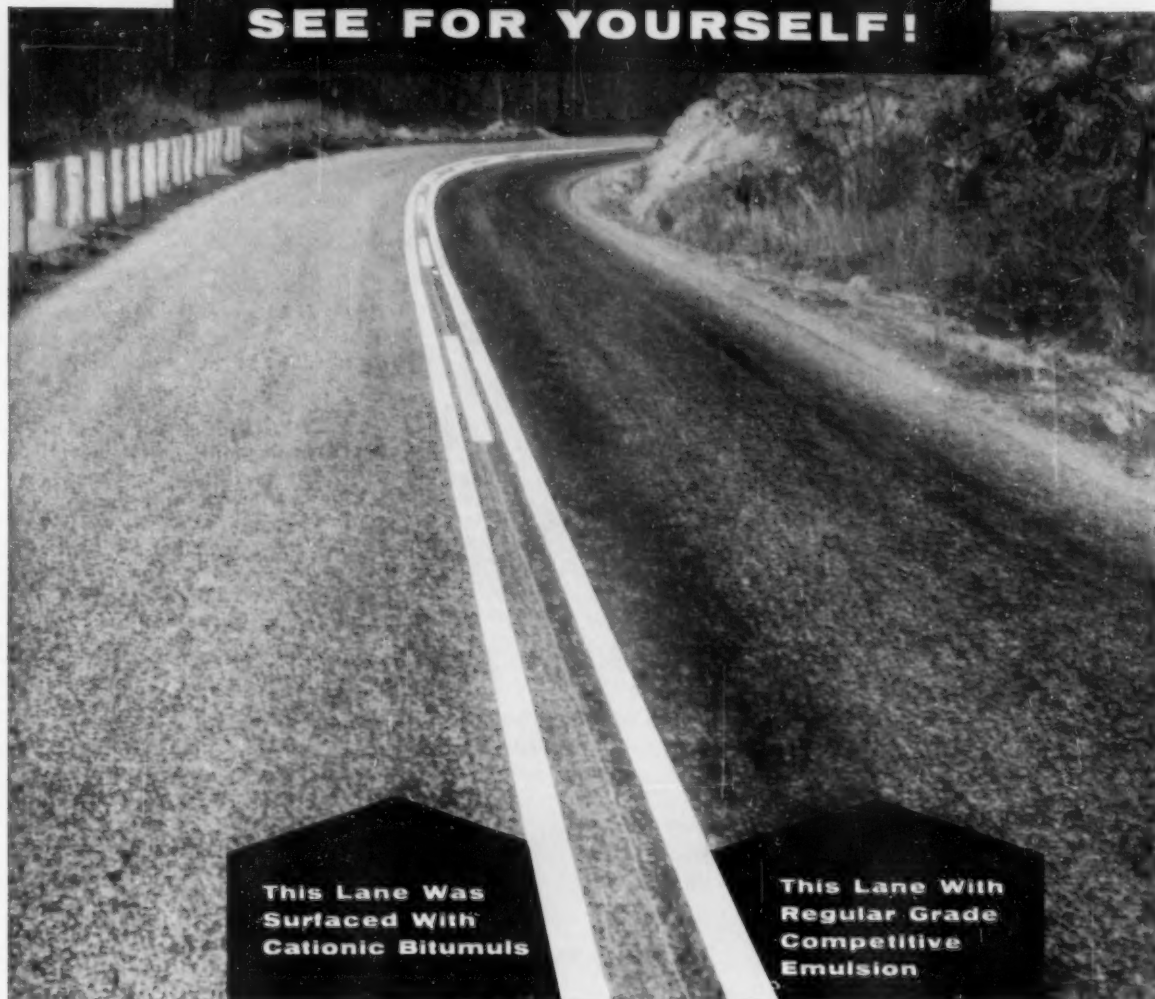
Erosion Control Dams

Erosion control structures that replace bridges on public roads are an integral part of a sub-watershed project of the Little Sioux River Basin in Iowa. They are developed and financed by the Soil Conservation and the County with the County or State paying for resurfacing the road and half the cost of the earthwork. Structures outside the sub-watersheds are financed entirely by the County or by the State Highway Commission. Two types of concrete structures are used to replace the bridges. If there is ade-



● TYPICAL designs for flexible pavements. Above, for a primary road, pavement uses bituminous concrete base and surface. For a secondary road, Class II, below, pavement has a soil-cement base, prime coat, double seal coat and cover aggregate.

SEE FOR YOURSELF!



You Get BETTER Surface Treatments With **CATIONIC BITUMULS**

This photograph gives visible proof of the superior performance of Cationic Bitumuls. The picture was taken on a 25-mile test section of highway in North Carolina.

Based on the success of this job, Cationic Bitumuls is being used for extensive surface treatment work throughout the State during the current construction season.

If you haven't tried this new material, call our nearest office today and arrange to test Cationic Bitumuls on your next pavement construction or maintenance job.

In every test made to date—whether in laboratory or field—Cationic Bitumuls has shown two outstanding qualities:

1. Unusual ability to hold aggregate, even "difficult" types.
2. Rapid initial set that minimizes damage from early rainfall.



American Bitumuls & Asphalt Company

320 MARKET STREET • SAN FRANCISCO 20, CALIFORNIA

| | | | | | |
|-------------------|-------------------|---------------------|---------------|--------------------------|------------------|
| Atlanta 8, Ga. | Portland 8, Ore. | Perth Amboy, N. J. | Mobile, Ala. | Oakland 1, Calif. | Baltimore 3, Md. |
| St. Louis 17, Mo. | Inglewood, Calif. | Cincinnati 38, Ohio | Tucson, Ariz. | San Juan 23, Puerto Rico | |

BITUMULS® Emulsified Asphalts • CHEVRON® Paving Asphalts • LAYKOLD® Asphalt Specialties • PETROLASTIC® Industrial Asphalts

AVOID *Playground* ACCIDENTS
with a

Saf-Pla

RUBBERIZED PLAYGROUND

Save your children the pain and discomfort of bruises and contusions suffered in falls on hard playground surfaces. Saf-Pla is designed to give children "a bounce instead of a bump". It is the internationally accepted Rubberized Playground for a variety of surfacing applications. Let us give you all the facts and figures on this safe, resilient and economical playground surfacing. Saf-Pla can be applied to black top, concrete or a good penetration base.

Write for Literature
Bulletin No. 17

U. S. RUBBER RECLAIMING CO., INC.
BOX 385 BUFFALO 5, N. Y.




Latent Grove Elementary School
Playground, Syosset L. I. N. Y.

Highway Snobbery!



PM FLASHER LIGHTS
with Plug-in Transistor Circuit
So good it's Guaranteed Forever!

Users of PM Transistor Neon or Incandescent Flasher Lights say: "They give better visibility... require less maintenance... and have four times greater bulb life, two times greater battery life, and 12 times greater lens life than other flashers—an extra job profit of \$3 per light per month for you." Adjustable flash rate, too!

Write for free demonstration. There's a PM Field Engineer near you.

Pacific Mercury
13232 Leadwell
North Hollywood 9, Calif.
Manufacturers of the Thomas Electronic Organ



New Kelly-Creswell Spray Gun Makes Road Striping Easier



Kelly-Creswell Company, Xenia, Ohio, has a new automatic striping gun for use on highway and industrial road marking equipment. Gun is patented. The gun is diaphragm-operated which eliminates the air cylinder and upper packing gland found in most spray guns. This eliminates the greatest cause of air loss in automatic spray guns. The new gun requires about 25% less air to operate at peak efficiency.

The gun is being installed on all the various types of striping equipment made by Kelly-Creswell. Also available as a replacement part. Kelly-Creswell is a pioneer manufacturer of a complete line of road-marking equipment—truck-mounted, power driven and hand operated.

For additional information write
Kelly-Creswell Company
Xenia, Ohio
20th year in exclusive manufacture of Striping Equipment

quate silt and water storage available, a floodwater detention type structure is used. This type of structure detains water above a road fill and allows it to drain out slowly after a storm. A typical example of a detention type concrete structure is a 24-in. pipe drop inlet structure. The drainage area is 473 acres and the total runoff during a 100-year storm is 101 acre feet. The peak flow is 885 cfs and the peak outflow is 73 cfs. Near the end of the storm there are 83 acre feet of temporary storage. Maximum stage above crest of this inlet is 9.6 ft. and freeboard at this stage is 2.4 ft. The structure itself consists of three parts: 1) The drop inlet is a reinforced concrete box 3 ft. x 3 ft. x 156 lin. ft. of 24-in. reinforced concrete pipe, in 6-ft. lengths fitted together by the tongue and groove method; and 3) the outlet is a small reinforced concrete chute. The other type of structure is the concrete culvert with a chute type outlet. This type of structure consists of the following three parts: 1) A culvert section; 2) a chute section; and 3) an outlet constructed as an energy dissipator.

"Erosion Control Dams Replace Old Wooden Bridges." By Carl A. Elsea, Hydraulic Engineer, Soil Conservation Service, Sioux City Iowa. PUBLIC WORKS, October, 1959.

Snow and Ice Control on County Highways

In Ocean County, New Jersey, the snow plows start to work after 1½ to 2 ins. of snow have fallen. When the snow becomes packed or ice has formed on the pavement, spreaders are used to treat the surface with abrasives. Sand mixed with 50 to 75 lbs. of calcium chloride per cu. yd. is used. Along some of the roads salt is spread at the rate of 400 to 600 lbs. per mile on a 30-ft. wide roadway. Two-way radio plays an important part in the snow operations and 22 of the county trucks are so equipped. Snow fences are set parallel and at a distance of 60 to 100 ft. from the edge of the road in areas where drifts constantly occur. The County Publicity Department aids in the snow removal problem by telling the public what to do in snow emergencies. Through the local newspapers, suggestions are offered to the public on how to cooperate.

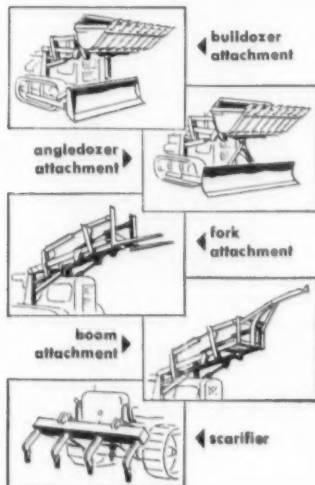
"Snow and Ice Control on County Highways." By Lawrence F. Wagner, Ocean County Engineer, Toms River, N.J. PUBLIC WORKS, October, 1959.

OLIVER



BUY THE LOADER THAT DOES MORE FOR YOU—OLIVER OC-126

...one work-test will prove it



Let your Oliver distributor demonstrate this versatile materials handler that can do more for you than any other machine—the Oliver OC-126 loader. Besides performing the usual loading, stockpiling and excavating jobs with the standard $1\frac{1}{2}$ -yd. bucket, the OC-126 mounts many other quick-change attachments to handle a variety of municipal assignments.

Now with "Spot-Turn" clutch steering, the OC-126 adds further to its usefulness with safe, locked-track pivot turns that permit cramped-area

operations, faster work cycles. With four forward and two reverse you get the right speed for every job, too. And there is plenty of power when you need it in the 60 h.p., gas or diesel, high-torque engines.

Add to this a selection of $1\frac{1}{4}$ -yd. rock or $2\frac{1}{2}$ -yd. snow buckets, bucket clearance of over 10', 44° bucket roll-back, and 3' digging depth, and you have the most useful municipal materials handler you can own. Ask your Oliver distributor to prove it to you on one of *your* jobs today.



THE OLIVER CORPORATION

Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio

a complete line of industrial wheel and crawler tractors and matched allied equipment

Street Resurfacing

Seattle, Wash., in the past 14 years has resurfaced approximately 350 to 375 miles of streets or about a third of the paved street mileage. Maintaining the existing resurfaced areas alone will require about 200,000 sq. yds. annually, and before a second resurfacing is accomplished, some places will require a third resurfacing. The city owns an asphalt plant with the plant producing about 41,000 tons of asphalt during 1958. In addition to producing asphaltic concrete the following are

produced: Sheet top—a mixture of asphalt and sand which is used principally for patching sidewalks where a durable feather edge is required; fine mix—a mixture of asphalt, sand and 5/16-in. maximum size crushed aggregate which is used on pavement patches; and a plant mix—a mixture of cutback (MC), asphalt, sand, and crushed aggregate which is similar to asphaltic concrete except that it is much softer. The plant can produce 700 tons during an 8-hr. day. A planer-burner is rented by the city to level off and remove the oxidized street surface. A Barber-Greene

spreader applies the plant mix material.

"20 Years of Street Resurfacing." By James Robertson, Principal Assistant, City Engineer, Seattle, Wash. *The American City*, September, 1959.

Planning For Snow

Each spring after the winter equipment is no longer needed, the Mechanical Department of the City of Hammond, Indiana, commences to check each piece of equipment. All worn parts are replaced and each loose piece is tagged and numbered to correspond with other parts. All metal parts are scraped and painted. After the 15th of September, personnel takes all the equipment and makes sure that all parts needed were put on and no repair part has been overlooked. Around October 15th, the Director of Public Services calls a meeting to preview the previous year's snow operation and discuss the present year's plans. A private meteorological concern provides weather service 24 hours a day, seven days per week from the first snow in fall to the last snowfall in spring. A standing rule in the department is that the general foreman and the director cannot leave the city at the same time during the winter months. A weekly list of drivers and helpers are posted who are to be on call after regular working hours. There is a union and all working time over eight hours a day is paid on a time-and-a-half basis and double time is paid for Sundays and holidays. Snow removal crews operate most efficiently in the business district between the hours of 11 pm to 7 am. Salt is used whenever possible and a mixture of salt and cinders are used when the temperature drops to zero.

"Winter Is Too Late to Plan for Snow." By Clarence A. Motz, Former Commissioner of Streets and Alleys, Hammond, Ind. *The American City*, September, 1959.

Interchange Spacing on Freeways

Interchanges should be located to facilitate the collection, discharge and dispersal of traffic. The selection of a proper type of interchange and the choice of location may have to be compromised due to the presence of railway or transit facilities, public utilities and topographic features such as rivers, streams and drainage channels. The matter of economics should be considered and the final decision should be based on the road-user benefits derived from the



EXCLUSIVE! Echelon Pattern Duplicates Hand Shoveling for Ice Control!

Spiral feed roller lays materials in heavier ridges that melt ice more effectively. Whereas thin blanket patterns can blow away. Pattern helps to identify curves, hills and stops... cautions drivers to slow down. This lower cost, one man spreader attaches to any standard truck frame allowing normal use of dump body. Feedgate controls coverage. Optional block-off plates adjust width of spread up to 9 ft. Forward and reverse transmission available.

Other Model J Features

- From road-travel position to spreading in 5 minutes. Operates at speeds up to 30 M.P.H.
- Spring loaded spreader hitch for fast, one-man hookup or disconnect
- All bearings sealed for life
- Machine-cut steel sprockets and heavy-duty roller chain
- Available with grooved roller to spread blanket pattern for seal coating

Write for the latest literature and complete specifications.

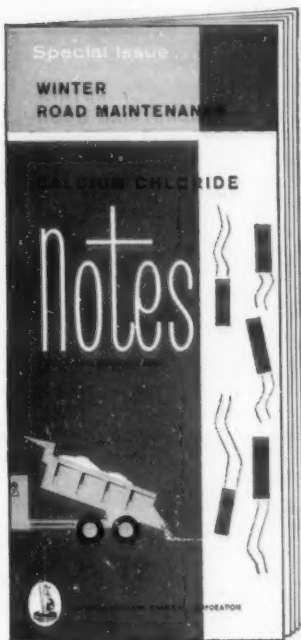
HIGHWAY EQUIPMENT COMPANY
620B "D" Ave. N. Y. • Cedar Rapids, Iowa



"why should I use calcium chloride-rock salt mixtures for ice control?"

The advantages are outstanding . . .

Effective—at *all* temperatures • **Faster Melting**—calcium chloride triggers action of the rock salt • **Easily Stored**—in the open under tarpaulin or sheds • **Economical**—greatly increased effectiveness with little or no increase in cost • **Adaptable**—to bulk shipments of both calcium chloride and rock salt • **Best Way**—to maintain bare pavements



This booklet contains the latest information including: why mixtures work better • how and in what percentages to store • mixing methods • recommendations for various storm conditions

WRITE TODAY for the assistance you desire

- ☐ Please send me free booklet
- ☐ Information on mixtures
- ☐ Information on treated abrasives
- ☐ Have engineer call

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

A Subsidiary of Pittsburgh Plate Glass Company • One Gateway Center,
Pittsburgh 22, Pennsylvania

DISTRICT OFFICES Cincinnati, Charlotte, Chicago, Cleveland, Boston, New York,
St. Louis, Minneapolis, New Orleans, Dallas, Houston, Pittsburgh, Philadelphia,
San Francisco IN CANADA Standard Chemical Limited

ACKER AP EARTH AUGER

The world's most versatile soil sampling rig

- Soil Sampling
 - Penetration Tests
 - Drive Sampling
 - Diamond Bit and Shot Core Sampling
 - Developing Rock Profiles
 - Permeability Tests
 - Locating Borrow Pits
 - Plotting Water and Sewer Main routes
- dozens of other applications



You can obtain accurate sub-surface information with the remarkably versatile Acker Earth Auger. Its design and built-in features permit speedy earth sampling with either large diameter single flight or continuous flight augers. The patented hydraulic head permits pressing samples or coring with diamond or inexpensive shot core bits. A rugged built-in hoist is handy for driving casing, doing standard penetration tests, or hoisting operations.

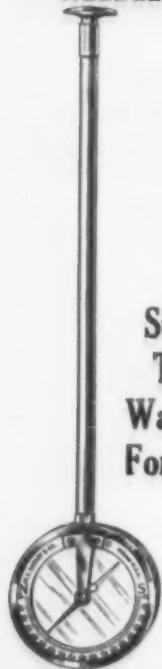
Whatever your soil sampling requirements may be, chances are, that this inexpensive, portable earth auger will do it better! You'll be surprised at the capacity and price of this incomparable rig!

Write today for Bulletin 40-R or 16mm sound movie on loan basis.

ACKER DRILL CO., Inc. P.O. BOX 830 SCRANTON 2, PA.

Over 40 years of experience manufacturing a complete line of diamond and shot core drills, accessories and equipment.

**DARLEY
MAGNETIC
DIPPING
NEEDLES**



\$17.50

**Standard With
Thousands of
Water Works Men
For Over 51 Years**

with 3 section
telescoping handle
←\$22.25

Write today for
100 Page Catalog
W. S. Darley & Co.
Chicago 12

CONCRETE TESTERS

The World's Finest
Low-Cost
Precision Testers

For
**CYLINDERS
CUBES
BLOCKS
BEAMS
PIPE**

IF IT'S A CONCRETE TESTER
YOU NEED-GET IN TOUCH WITH

FORNEY'S, Inc.

TESTER DIVISION

P. O. BOX 310 • NEW CASTLE, PA.

construction of the interchange. The location and spacing of interchanges will be affected by the size of the city and the type of area. Other related factors that may affect a free choice of the designer would involve legal, political and military considerations. The spacing of interchanges will be affected by the design speed of the facility, the number of lanes and the type of ramps. In urban areas the close spacing of interchanges will produce weaving sections, which usually have an adverse effect on the operation of the freeway. Collector-distributor roads and braided and separated type ramps may be required to reduce the effect of weaving on the flow of through traffic. On some of the constructed interstate highways in Texas, the average interchange spacing varies from approximately 1 mile in the more populated areas to 6 miles in the sparsely populated areas.

"The Effect of Interchange Spacing." By Stefan Salek, Senior Engineering Assistant, Texas Highway Dept., Austin, Tex. PUBLIC WORKS, October, 1959.

Cold-Weather Public Works

Fairbanks, within the permafrost area of Alaska, has developed interesting means of providing city facilities despite heavy cold. For public works projects, special designs that will operate in a subarctic climate are essential, as well as special equipment and skills for the maintenance of these projects. A case in point is the sewer system, which is constructed entirely of wood-stave pipe with wood-stave manholes, primarily because of the freezing weather. Maintenance of this system in winter requires steam boilers to thaw the lines. In the water system, the water circulates water constantly through the mains, makes it possible to add heat when required, and, through dual house services, provides for circulation to the heated area of the customer's building. In snow removal, when the temperature goes below -35°F , the belt loaders become inoperative and rotary plows must be used. Operations cease when the temperature reaches -50°F . Construction equipment and vehicles used in winter months must be specially equipped with extra lights as well as with gasoline burning heaters for personnel and electric engine heaters for prestarting heat. Special lubricants and anti-freeze mixtures must be employed to protect against the weather. The ballasts in the street



CITY STREETS

proved on all
types of jobs



SERVICE STATIONS



PARKING LOTS



PLAYGROUNDS

**Barber-Greene
873 Finisher**



DRIVEWAYS



HIGHWAYS



HIGHWAY SHOULDERS



ALLEYS

paves on crawlers...
travels on rubber



Here's the only asphalt finisher that paves on crawlers and travels on its own hydraulically retractable pneumatic tires. Write for new bulletin describing such exclusive Barber-Greene features as automatic tamping, leveling and thickness controls . . . new, hydraulically folding hopper . . . simplified controls with single-stick steering.

59-15-F

Representatives in Principal Cities of the World

Barber-Greene

Main Office and Plant AURORA, ILLINOIS, U. S. A.
Plants in DeKalb, Illinois, Detroit, Canada, England, Brazil, Australia



CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

Dodson's Digest



Snow Scene

It was a great day for tow trucks, but I sure had everyone else stopped cold. A sudden cold snap had brought snow, ice, and sub-zero temperatures . . . the works! I got stuck twice within half an hour, and got out both times with salt-Calcium Chloride mix. Luckily, I had just filled the small box I carry in the trunk.

That's why I felt duty-bound to stop when I saw a young couple in what looked like a totally hopeless situation. He was pushing and she was spinning the wheels . . . digging in deeper by the minute. I got out of my car and approached them. He gave me kind of a surly look—but who could blame him under the circumstances?

"Need help?" I asked.

"Don't think so," he answered, curtly.

"I've got some salt-chloride mix in the trunk that'll have you out in no time," I persisted.

"We've tried salt," he said.

"This is a mixture of salt and Calcium Chloride," I explained. "Salt alone won't work at temperatures like this."

"Listen, Bub, I know what I'm doing," he snapped. "Just run along, will you?" So I started on my way. But, fortunately, the girl had been listening.

"Please come back," she called.

"Your suggestion sounds like a good one. Let's try it."

She was polite, and she was pretty. I sprinkled some of the salt-chloride mix in front of the rear tires. It was a pleasure. After a short wait, I told her to start up easy. She did, and off she went . . . alone . . . waving her thanks. I was surprised, and I'm sure it showed.

"What about you?" I asked her companion.

"What about me?" he snarled. "I was just getting acquainted with that doll when you came along with your bright idea."

— L. D. DODSON

P.S. One part of Wyandotte Calcium Chloride to three parts of salt works much faster than straight salt, and is effective at lower temperatures. Reason: Salt has little ice melting ability below 20°F.; Calcium Chloride works at temperatures as low as -59°F. Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.

Wyandotte
CHEMICALS

MICHIGAN ALKALI DIVISION

HEADQUARTERS FOR CALCIUM CHLORIDE



lighting system are guaranteed to operate down to -40°F, but they do work at colder temperatures.

"Cold-Weather Public Works."

By Robert L. Crow, Director of Public Works, Fairbanks, Alaska, *Civil Engineering*, September, 1959.

Seattle, Washington A Symposium

This seven-article symposium, prepared by City Engineer Roy Morse, and his associates, is a comprehensive review of Seattle's street and traffic problems and accomplishments in any one time and place. Here are the articles: "Services for the Motor Age," by Roy W. Morse, City Engineer and Chairman, Board of Public Works; "The Seattle Metropolitan Freeway System," by James Robertson, Principal Assistant City Engineer; "Traffic Control and Parking Developments," by E. E. Lewarch, Traffic Engineer; "Ten Years of Safety Street Lighting," by H. Ward Tyler, Principal Engineer; "Street Planning and Construction," by E. H. Lindstrom, Principal Engineer; "Street and Bridge Maintenance and Street Cleaning," by D. A. Andersen, Assistant City Engineer; and "Shops and Equipment Facilities," by H. E. McMorris, Principal Engineer. *Street Engineering*, September, 1959.

Roadside Spray Program

A chemical weed-spray program was begun in Vermont in 1954. The original program was for control of poison ivy, but it has been expanded to include all noxious weeds and woody growth. Before 1957 the work was done by contract, but in 1957 it was decided to purchase spraying outfits for all 12 highway department districts. This included 12 pumps with hoses, gauges and nozzles and twelve 275-gal. fuel-oil tanks. Each unit was mounted on skids for convenient trucking. The total cost amounted to \$2,520, of which \$504 was to be written off each year for the next five years. Also bought at this time were 175 gal. of 2,4-D and 215 gal. of 2,4,5-T. In 1957 only 100 miles of roads were sprayed at an estimated cost of \$50 per day per crew. Each crew consisted of two men and a minimum of 20 mph per day was sprayed. Allowing for equipment write-off and labor, the actual expenditure was \$30.42 per mile. In 1958 a switch was made to 2,4,5-T acid propylene glycol butyl ether esters. Some 480 miles were treated for \$21.91 per mile and results were good. The

new chemical, although more expensive per gal., gave a better kill on both weeds and brush and the department believed it was worth the price.

"Roadside Spray Program Has Produced Excellent Results." By William J. Goodheart, Landscape Engineer, Vermont Dept. of Highways. *Better Roads*, September, 1959.

Other Articles

"The Economic Impact of Elevated Expressway Construction." By Harry A. Taylor, President. Frank H. Taylor & Son, Inc., East Orange, N. J. The American City, September, 1959.

"Roadbuilding Through Hills of Clay." By C. B. Laird, Chief Construction Engineer, Michigan State Highway Department. *Public Works*, October, 1959.

"Put It on Microfilm." A long range plan was prepared in the Highway Department of Cook County, Ill., for a new and modern system of records keeping. By F. A. Cerwin, Records Administrator, Cook County Highway Dept., Chicago, Ill. *Public Works*, October, 1959.

"Westchester County Spearheads Trend Toward New Directional Signs." By Arthur Freed, Traffic Engineer, Westchester County Dept. of Public Works, White Plains, N. Y. *Public Works*, October, 1959.

"Soil-Cement Use Spreads in Mississippi." *Rural Roads*, September-October, 1959.

"Waging War on Weeds and Brush!" Both chemical spraying and mechanical cutting are required in any successful campaign against roadside plants. *Rural Roads*, September-October, 1959.

"Impact Tests." Barrier test crasher reveals valuable data. By John L. Beaton, Chief, Structural Materials Section, and Robert N. Field, Jr., Materials and Research Engineering Associate, California Dept. of Highways. *California Highways*, July-August, 1959.

"We Begin Our Winter Maintenance Battle in Summer." Advance planning is one reason why the Ohio Turnpike has never shut down for a single day despite its location in a notorious snow and sleet belt. By Duane L. Cronk, Director, Highway Information Services, Inc., Washington, D.C. *Roads and Streets*, September, 1959.

"Complete Photogrammetry Unit Set Up in Department." Missouri's photogrammetry department has been in operation since June, 1959. Department bought airplane, aerial camera and other necessary equipment. It selected six men from the districts and gave them intensive training in photogrammetric methods. *Better Roads*, September, 1959.

"Team Work Helped Oswego Battle Record Snow Storm." It snowed for 10

consecutive days in varying amounts, dropping 67 in. during the first three days and a total fall of 118 in. during the 10 days. By Robert Dymont. Street Engineering, September, 1959.

Highway Research Council of Ohio

Formation of the Highway Research Council of Ohio has been announced by Ohio Governor Michael V. DiSalle. The Council's function will be to encourage research activities in highways in Ohio. Current members of the council are from the Ohio Department of Highways and The Ohio State University College of Engineering.

Present members are: Highway Director Everett S. Preston, chairman; Dean Harold A. Bolz, of The Ohio State College of Engineering, vice chairman; Prof. Robert F. Baker, director of civil engineering research at The Ohio State Engineering Experiment Station, secretary; G. A. Berry assistant director and chief engineer for the Ohio Department of Highways; Robert S. Green, associate dean of the College of Engineering and executive director of the Experiment Station; and Prof. Emmett H. Karrer, of The Ohio State Department of Civil Engineering.

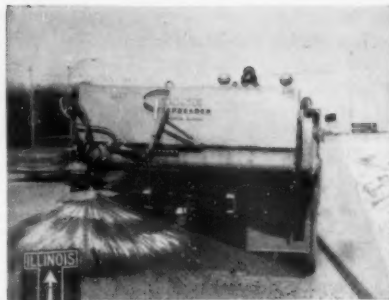
Research projects, on which work is getting under way, include studies of utilization of electronic devices as traffic aids, development of equipment and methodology for utilizing nuclear energy for quality control of highway materials, deformation and flow properties of bituminous concrete and bases, behavior of continuous skewed concrete slab bridges and flow of ground water through highway embankments.

Other studies being considered include such subjects as highway traffic accidents, highway economics, slope stability and processing of aggregates for pavement construction.

The Council plans to give special emphasis to possible uses of nuclear energy in the highway construction field. The following studies are among those contemplated:

Use of a reflection thickness gauge to determine the thickness of paint and other coatings on various highway materials, use of trace radioisotopes to determine the rate of wear or service life expectancy of materials such as traffic paint and surfacing materials and use of radioisotopes to produce luminous paints for traffic and information signs.

Use of radiography to locate steel reinforcing and/or voids in 12-in. to



Flink HDWS4 Completely Hydraulic Tailgate Spreader — A fleet of these efficient rigs help keep traffic rolling on the Illinois Tollway! Left-rear spinner permits easy 2-3 lane spreads in one pass; saves material. Hydraulically operated, Cab controlled, 2-speed auger permits instant change from abrasives to straight rock salt. Volume controlled by hydraulically operated feedgate.



Flink LMC Hopper Spreader — Handles salt, cinders and sand for heavy-duty ice control. Pea gravel and chips for seal coating. Choice of PTO, hydraulic or gasoline engine drive, Cab controlled. Uses the only power transmission of its kind in the field. No worm gears, no "out-of-straight" shafts of U-joints. Differential equalized drive.

Select FLINK SPREADERS

When Specifications Require

- ONE MAN OPERATION
- LOW MAINTENANCE
- LOWER COST



Flink HD42 Hydraulic Drive Tailgate Spreader — Self-feeding. Handles sand, chips, cinders, calcium chloride, chat etc. Forward spread for ice control, reverses for seal coating. Spreads from width of truck to width of street, thick or thin. Replaces tailgate on present trucks. Trips for dumping just as original tail-gate did.

Flink Model SS Pull-Type Spreader —

Can't be beat for simple maintenance and operation. For low cost ice control, seal coating and dust control.



BAKER SNOW Flink PLOWS

FOR FAST, LOW COST SNOW REMOVAL!

Reversible or one-way plows for 1½ to 5 ton trucks and up. Sectional or one-piece, full length cutting edge trip. Exclusive blade-hinge weldments in place of hinges cut maintenance. Full 3¼" wear on a 6" cutting edge. Operating position adjustable 65° or 75° from horizontal.



For literature or name of nearest distributor, write:

THE
Flink co.

STREATOR, ILLINOIS

5513 North Vermillion Street

18-in. thick concrete beams and slabs, development of reflection thickness gauges capable of determining the exact thickness of concrete and bituminous surfaces and use of nuclear density determination devices to ascertain the quality of in-place concrete.

Use of radioisotopes in construction to determine the minimum mix-

ing cycles for Portland cement and bituminous mixes and determination of the flow of water both on the surface and underground from the point of fall to the location of the structure by means of trace radioisotopes.

Use of trace radioisotopes to investigate the movement of moisture in soils and to determine penetra-

tion and retention of soil additives such as calcium chloride; use of present nuclear moisture determination devices to ascertain the effectiveness of concrete curing compounds; and use of radioisotopes to study absorption of fertilizer and inhibitors by roadside growth and to make quantitative measurements of the corrosion of embedded steels.

BRIDGE AND PAVEMENT DESIGN

FOR THE

INTERSTATE ROADS IN MICHIGAN

HAROLD R. PUFFER,
Engineer of Bridge and Road Design
and

OLAF L. STOKSTAD,
Design Development Engineer,
Michigan State Highway Department

PRESENT highway design practice in Michigan is the product of an evolutionary process. The general study of design effectiveness has been accomplished through informal observation and by means of follow-up condition surveys conducted on highways in actual service. Such surveys have included soil classification surveys, as well as pavement condition surveys. The latter have been repeated at regular intervals in order to measure the rate at which pavements depreciate under the influence of normal traffic extending over years of exposure to Michigan's climate.

In addition to the general research program, as mentioned above, there have been many trial installations to study the actual service suitability of various construction materials, construction methods and special design practices.

By this means, it has been possible to adapt design practices from other sources and to develop new ones to fit environmental conditions peculiar to Michigan. In this manner also, standard pavement strength designs have been developed for the normal conditions of soil and traffic. Variations from the pavement design standards are arranged to satisfy demands imposed by the extremes in soil, traffic or climatic conditions as they are encountered. The granular subbase, for instance, is omitted when building over soils

consisting of free draining sands and gravels.

The objective of pavement strength design in Michigan is to obtain a highway which is strong enough for unlimited use by maximum legal axle loads at all seasons of the year. For expressway construction this design involves a modest safety factor, partly in anticipation of possible changes in legal weight limitations but mainly to satisfy the needs for a structure which will be adequate for the overloads regularly moved over the highways under a system of special permits.

Strength design procedures are based on techniques developed around both the Westergaard subgrade modulus "K" and the California bearing ratio as these factors were adapted by the Corps of Engineers for use in military construction. Michigan's technique involves two variations from the procedures as outlined in the manual for military construction.

- 1) It is necessary to compensate for the difference in the number of load repetitions to which highway structures and runway structures are subjected. Generally, this is accomplished by assuming that the runway wheel load is equivalent to the highway axle load.

- 2) Subgrade strengths as expressed by the subgrade modulus "K" or by the California bearing ratio have over the years become associated with natural soil profile formations so that when these have been identified by the soil survey, the normal foundation strengths prevailing during the various seasons are known.

There is no need, therefore, to make field "K" value determina-

tions or CBR value tests on random samples, especially when these do not reflect strengths which will prevail during the critical spring thawing period. There is as yet no satisfactory technique developed for determining correction factors to be used in converting test results to those which would accurately reflect controlling foundation strengths. In Michigan, such testing techniques would, no doubt, need to include cycles of alternate freezing and thawing.

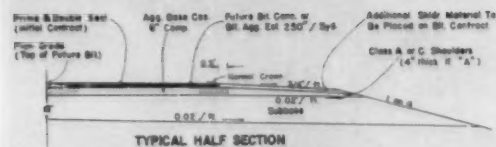
To provide maximum safety, convenience and comfort for the highway traveler involves more than pavement strength. It involves a wide range of design details including cross sections alignment, sight distances, slopes, etc., covered under the general heading of geometrics. In this field AASHO Standards serve as a guide to minimum requirements.

The median width is one feature of this section which varies from project to project and also from one section to another within the same project. The two legs of a dual lane highway may be built on separate alignments for esthetic, as well as for economic reasons.

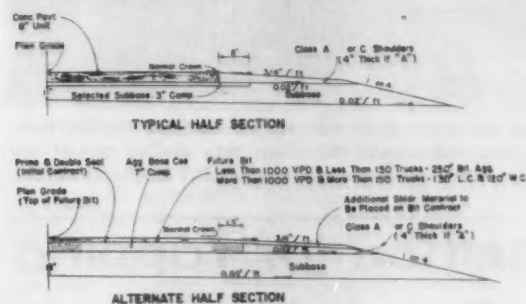
Limited Access

Limited access is an important feature of all expressway type construction in Michigan. Highway bridge building has, therefore, taken on new importance in the transportation picture. Michigan bridges are predominately of the deck type designed with end spans extending across the side slopes and with small abutments built in the approach fills. This design has been used for many years because of its economy

LESS THAN 500 VEHICLES PER DAY



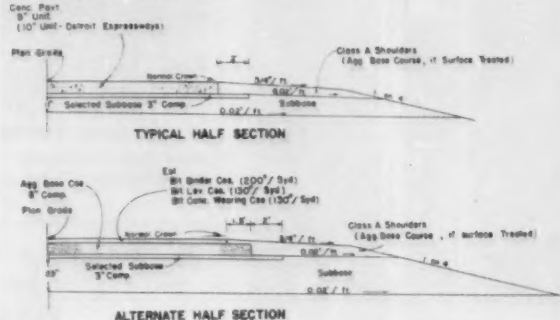
500 TO 2000 VEHICLES PER DAY



NOTES:

Sections are designed for 32,000-pound tandem axle loads with reasonable factors of safety.
Traffic volumes shown are for current traffic and for two lane highways.
When these sections are to serve as one roadway of a dual, traffic volume may be increased by 50 percent.
Projects in municipalities will be governed by specific instructions.

2000 OR MORE VEHICLES PER DAY



● TYPICAL CROSS-SECTIONS for highways in Michigan. Designs are based on the volumes of traffic that will use them.

and good visibility through the structure. The slope areas under the end spans are paved with either grouted flagstone or precast concrete blocks. Bridge piers are of the reinforced concrete column and girder type, with continuous footings.

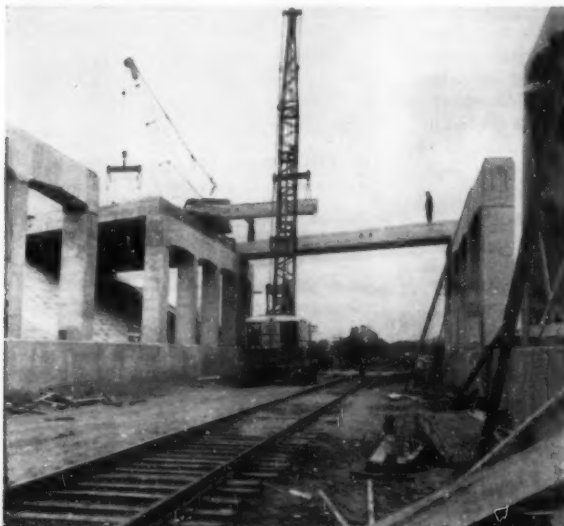
Generally the three most common structural types used consist of the 1) roll beam deck with concrete slab designed for composite action of the beams and slab through the use of either spiral or stud shear connectors; 2) continuous reinforced concrete T beams; and 3) precast prestressed structures either of a box type or I-beam type with reinforced concrete slabs. There are, of course, exceptions to the above types, such as the use of built-up girders for some of the longer spans,

with two to four girders to a span and with a floor system supporting the reinforced concrete deck. On structures which do not provide for sidewalks an aluminum pipe railing is presently being used. This is placed on top of a 10-in. curb with a minimum distance from the face of the curb to the face of the railing of 1 ft. 6 in. In urban areas where we have sidewalks on the bridges an aluminum railing is used consisting of top and bottom rails with a web system between the rails. It is believed this type of railing offers more protection to pedestrian traffic than the conventional pipe railing.

All bridges on Michigan's Interstate System are designed for the modified H-20 S-16 loading, and all bridges on the trunkline system are designed for H-20 S-16 loading.

Foundation investigations are made by the Soil Engineering Division of the Office of Testing and Research. In addition to classifying the types of soil encountered, standard penetration tests are obtained for the foundation materials. In addition, the shearing resistance of clay materials is determined by the ring-shear method in the Department's laboratory. By using the shearing value of the soil to determine the allowable foundation pressures, it was found that the use of foundation piling in a good many cases could be eliminated. When foundation piling is required, the types most commonly used are timber piles, steel H piles or cast-in-place concrete piles. The choice is determined by the foundation conditions encountered.

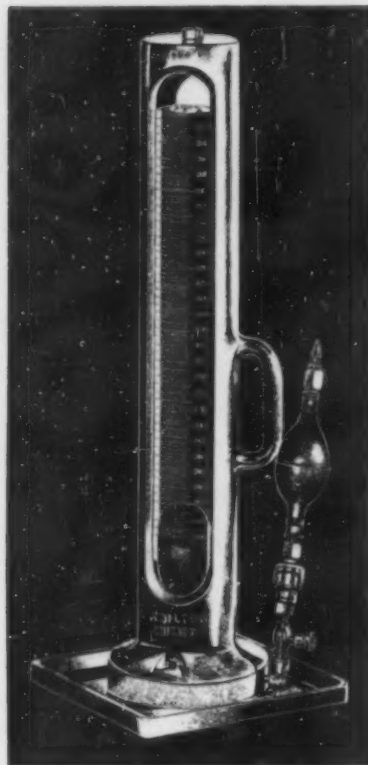
● PLACING box-type prestressed beams for a bridge over a railroad. Location is on Interstate Route 96 in Michigan.



● SPECIFICATIONS for dual highways require rounded bottom ditches at shoulders plus median ditch to drain subbase.



SOIL COMPACTION



VOLUMEASURE for fast, accurate IN-PLACE DENSITY

TESTING of SOILS

PRICE \$95.00 F.O.B. CHICAGO

Write for complete
Catalog of Engineering
Test Apparatus.

SOILTEST
Incorporated

4711 W. North Ave. • Chicago 39, Ill.



● FOR CONSTRUCTION of this sand-asphalt road, the Florida State Highway Dept. used two passes with scarifiers and Seaman Pulverizer; then applied asphalt and spread material with a Huber-Warce Motor Grader. Tandem roller compacted surface.

A New Method for Tapping Into Sewer Lines

TWO METHODS have been used in the past for making taps into sewer lines. One has been the installation of wyes during original construction, with a record being kept of their locations. Another has been the use of tapping saddles, requiring cutting into the pipe with a hammer and chisel.

A new method has been developed by the Shewer Tap Co., Inc., Kansas City, Mo., which utilizes a hand or power operated core drill to cut a perfectly round hole in any size clay pipe and remove the core in one piece. The hole is cut to a dimension to receive an aluminum alloy adapter which is fastened permanently and tightly to the pipe by an epoxy resin to provide a root-proof and non-leaking joint. The connection is said to have a strength in excess of the strength of the original pipe. The adapter does not obstruct flow in either the house sewer or the main sewer.

The tap drill is furnished with tools for cutting in 4-in. and 6-in. connections. A hand ratchet provides power for cutting on the standard model, but power equipment is available at extra cost. The hand powered model will drill a 4-in. hole in 6 minutes or a 6-in. hole in 8 minutes. Air or electric power will cut the holes in approximately four and six minutes, respectively. No undue or damaging pressures are exerted on the clay pipe during drilling operations. This is illustrated by the fact that holes have been drilled 1 in. apart in clay pipe, leaving the pipe undamaged and uncracked.

The epoxy joint compound is packaged in individual cans adequate for one connection. The material is of two components, both of which are in the can. These are stirred together and applied with a putty knife before the tap is inserted into the hole. The laying and jointing of the house service sewer may be started immediately after installation and there need be



● THE Shewer Tap, an aluminum alloy adapter, is cemented to the pipe by epoxy resin to form a waterproof, root-free joint for house sewer connections.

no delay in backfilling. The tap is of standard bell dimensions and will take any pipe or jointing method normally used in house sewers, including standard field couplings for polyvinyl chloride joints.

ANALYSIS OF VACANT LAND in the City of Chicago

In 1958 Chicago had 21.3 square miles or 13,630 acres of vacant land. This is undeveloped or agricultural land which is being put to no permanent urban use. Vacant land comprised 9.5 percent of Chicago's total area of 224.029 square miles or 143,378 acres, including Chicago-O'Hara International Airport. Of the vacant land, 17.2 square miles or 10,991 acres, is unimproved and not being put to any use either temporary or permanent. The remaining 20 percent of the vacant land, 4.1 square miles or 2,639 acres, is improved without a permanent structure but having some use or activity.

By location, 83 percent of Chicago's vacant land, consisting of 17.6 square miles or 11,249 acres, is located south of Cermak Road. From 79th Street to the southern City limits there are 12.6 square miles or 8,045 acres of vacant land. From Cermak Road to 79th Street there are 5.0 square miles or 3,204 acres of vacant land. Only 17 percent of Chicago's vacant land is north of Cermak Road. From North Avenue to the northern City limits there are 2.3 sq. miles or 1,501 acres of vacant land. Only 1.4 square miles or 880 acres of vacant land are located between Cermak Road and North Avenue.

Vacant land zoned for manufacturing use comprises 46 percent of the total and amounts to 9.8 square miles or 6,240 acres. Next in importance is vacant land zoned for residence which includes 8.3 square miles or 5,323 acres; 1.2 square miles or 792 acres is vacant land zoned for business use. Even less area, 0.7 square mile or 466 acres, is vacant commercial land.

All the remaining vacant area, amounting to 1.3 square miles or 809 acres, is improved vacant land used for parking, and may be any zoning type.

Readily developable vacant land (excluding improved land and small, scattered vacant parcels) is estimated to amount to 16.6 square miles or 10,639 acres—about 78 percent of the total vacant land in Chicago. Vacant land zoned for manufacturing which may be readily developed consists of 8.9 square miles or 5,701 acres. Residential vacant land which may be readily developed amounts to 5.7 square miles or 3,680 acres. Only 0.8 square

mile or 549 acres of vacant business land is estimated to be readily developable. Approximately 0.4 square mile or 267 acres of vacant commercial land would appear to be readily developed.

Vacant unimproved residential land may be developed to provide a maximum of 66,000 to 79,000 dwelling units, based on the maximum number of dwelling units per acre presently permitted by the Zoning Ordinance. From 26,000 to 39,000 dwellings may be built in

Street Sweeping and Flushing in San Francisco

Eleven motor-sweepers are in service in the Bureau of street cleaning of San Francisco. Bin capacities of these sweepers vary between 2 and 4 cubic yards. Typical sweeping conditions and performance results for the year, are summarized as follows: Sweeping-machine routes are scheduled, so far as possible to start from the garage door and finish the day's work at the garage so as to reduce "dead-heading" or unproductive service.

Motor - sweepers empty their refuse bins along the route for later pickup and haul to dumps. On an average, sweepers empty bins about twice a day. Each stop consumes about 12 minutes. When all sweepers are working it requires 1 truck with a crew of 3 men for 3 hours and one overhead loader with a crew of 2 men for 8 hours to haul a total daily average of about 35 cubic yards of debris to the dump grounds for final disposal.

Sweepers refill water tanks on an average of about 4 times a day, consuming about 8 to 18 minutes for each such operation. An average of about one hour per day per sweeper is consumed in routine sweeper maintenance and about one hour in traffic stops.

Most satisfactory sweeping speeds vary between 3 and 6 mph, depending on conditions involved such as traffic-density and topography.

Sweepers in operation during the year averaged 124 miles per day or about 22 miles per sweeper per day.

For flushing pavements, nine motor flushers are used. These normally operate in the traffic lane next to the car parking strip at travel speeds of 8 to 10 miles an

single-family residence areas and the remaining 40,000 dwellings may be built in multi-family areas.

Although this maximum number of dwellings may be built on vacant residential land, the economic considerations of private development frequently set a lower maximum density than that permitted by the Zoning Ordinance.

Since 1941 the amount of vacant land has declined from 46.4 square miles or 29,675 acres to 21.3 square miles or 13,630 acres, an average decline of 1.4 square miles or 891 acres each year. Continuation of this rate of development, in the absence of substantial annexation or land clearance, would produce a totally built-up city by 1973.

hour. Flushing water is generally applied to street surfaces through 2 nozzles at varying safe pressures. One of the nozzles is at the front left side of the vehicle and the other nozzle is on the right side near the rear of the cab. The flushing water is directed toward the gutterways at controlled pressures ranging between 20 and 40 psi. In this operation an area for about 26 feet from the curb is cleaned. Nozzles discharge an average of about one gallon of water in a little less than 4 ft. of travel. The motor flushers are equipped with a third nozzle on the left side of truck, near the rear of cab, which is also used on special occasions such as on one-way streets and streets having dividing strips. In order to avoid traffic hazards at intersections the cross-street is not normally flushed, except that in wet weather crosswalks are sometimes flushed to remove oil scum deposits.

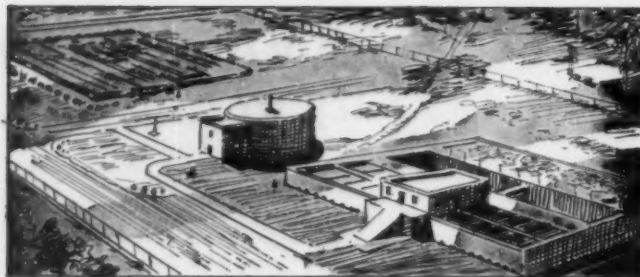
• • •

Special Courses by the Public Health Service

Special courses will be given by the Public Health Service at the R.A. Taft Laboratory in Cincinnati as follows: "Radioactive Pollutants in Air" Jan. 25-29; "Radioactive Pollutants in Water" Feb. 8-12; "Radionuclides in Water" Feb. 15-19; and "Sanitary Engineering Aspects of Nuclear Energy" March 14-25.

For applications or requests for information address the Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or a PHS Regional Office Director.

THE SEWERAGE AND REFUSE DIGEST



Prepared by ALVIN R. JACOBSON, Ph.D

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Frothing Evaluation

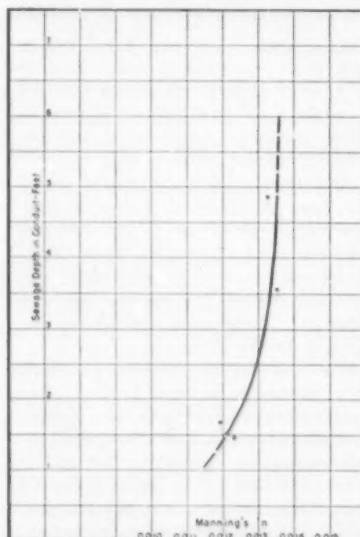
The principal factors that have been given consideration in relation to frothing in aeration tanks in sewage treatment plants are: 1) The presence of surface active agents; 2) the effects of suspended solids concentrations in mixed liquor; 3) the presence or absence of anti-foam substances; 4) the formation of foam stabilizers by the biological floc in the aeration process; and 5) aeration rates. In addition, other factors have been observed as having some effect, such as pH, time of day, dissolved oxygen concentration, sludge age, strength of sewage, and certain meteorological conditions. In order to obtain further information a questionnaire survey followed by a laboratory study of frothing under various conditions was made and the results are reported in this article. From this study the following observations are evident: 1) The ABS concentration in the mixed liquor filtrates was significantly correlated to the frothing parameters and accounted for more of the variation than any other single factor; 2) the organic nitrogen concentrations were not significantly correlated with frothing; 3) the BOD concentration was not significantly correlated; 4) a significant negative correlation was obtained with electrode potential measurements indicating that frothing is less in the advanced stages of nitrification; 5) for both pH and temperature of the mixed liquor samples, significant positive correlations were obtained for the persistency measurements; and 6) the suspended solids concentration of the mixed liquor was significantly correlated negatively to the froth parameter.

"Evaluation of Frothing in Sewage Treatment Plants." By L. B. Polkowski, G. A. Rohlich, and J. R.

Simpson. *Sewage and Industrial Wastes*, September, 1959.

Roughness Coefficients

Recognizing the general need for more field data on sewer hydraulics, the author undertook an investigation of flow and velocity measurements of an important trunk sewer in Kansas City, Missouri. This investigation was coordinated with a larger study on a master plan for trunk sewers and sewage treatment facilities for this metropolitan area. The conclusions were: 1) Variations in Manning's n occur with changes in depth of flow in sewers; 2) a number of conditions brought about during construction of a sewer or which may occur afterwards, can change the value of n from that used in the design of the sewer: 3) bot-



Courtesy Sewage and Industrial Wastes

● STUDY showed this variation of Manning's n with the depth of flow.

tom deposits or other conditions which greatly alter the invert surface of the sewer probably cause a greater variation in n than that caused by changes in depth of flow; 4) past laboratory experimental work has been valuable but there is need for much more work to determine the value of n under actual field conditions; 5) further investigations should be made to: a) remove the uncertainty as to how n varies with conduit size, if k is assumed constant; b) examine the suitability of the parameter k for the various flow conditions experienced in the field; and c) determine more exactly the regimes of flow encountered by sewage flow in conduits. 6) The methods described here to measure mean velocity is regarded as simple, accurate, inexpensive and, in certain cases, far easier to use than more conventional procedures.

"Measurement of Manning's Roughness Coefficient." By O. John Schmidt. *Sewage & Industrial Wastes*, September, 1959.

Bakersfield's "Sewer Farm"

Bakersfield, a city located in a semi-arid portion of the San Joaquin Valley of California, has constructed a new sewage treatment plant to augment the capacity of its original primary treatment plant. The effluent from these two plants is used for the purpose of irrigating the city's 2,500 acre sewer farm which has been rented to a large farming organization at a nominal annual rental fee. The use of 8,480 acre-feet of this primary effluent for crops not intended for human consumption, i.e., cotton, feed corn, milo maize, sugar beets, barley and permanent pasture for cattle, has reclaimed marginal alkali land of low value into a fertile farm resulting

ACID-RESISTANT, WATER-TIGHT, QUICK-COUPLING JOINTS
for straight and offset concrete sewer pipe

with **TYLOX®**
"C" SERIES
flexible GASKETS

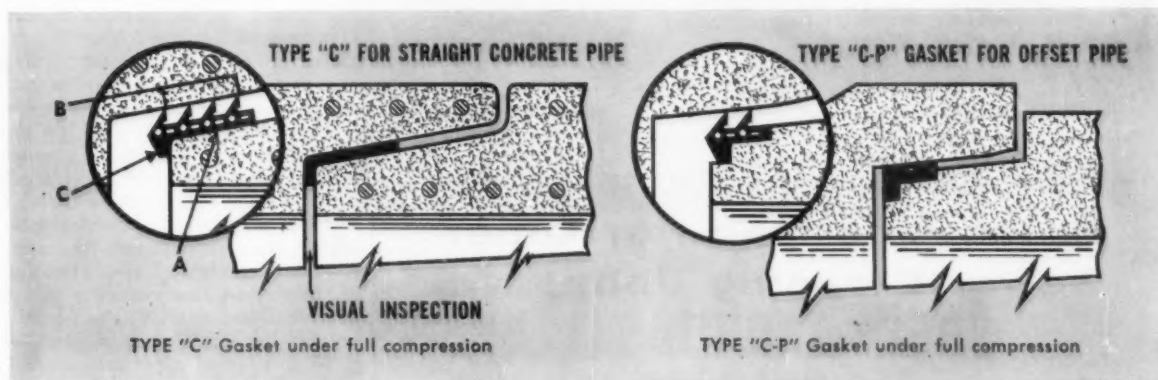


Sanitary Engineers can take advantage of the matchless efficiency of TYLOX Flexible Gaskets for coupling *any* concrete pipe sewer they design . . . because there's a specially designed TYLOX cross-section for *any* type of concrete pipe!

Type "C" Gaskets for straight, and type "C-P" Gaskets for offset pipe, provide the same high performance features you are accustomed to in famous Type "A" Gaskets . . . PLUS a visual inspection feature made possible by a flange which overhangs the edge of the pipe tongue, or tongue offset, according to the type of pipe. On pipe large enough to admit workmen, proof

of correct gasket positioning can be obtained by noting whether the inspection flange is evenly seated around the entire circumference of the joint. The larger the pipe, the more important this visual inspection feature becomes.

TYLOX "C" Series Gaskets are made for all pipe sizes, handle head pressures up to 50-feet, and are available in either rubber or neoprene. They may be applied to pipe at the pipe manufacturer's plant, or at the job site. Like all TYLOX Gaskets, they are immune to sewerage and industrial waste acids, and keep joints *water-tight* for the life of the pipe itself.



"C" Series TYLOX Gaskets consist of base A; sealing fins B; and inspection flange C. In addition to providing the inspection feature, the "locking" effect of the flange holds Gasket in true position as pipe is coupled. Design of the sealing fins is such that horizontal end-thrust forces causing "kickback" in some couplings, are eliminated in Tylox "C" Series Gaskets, assuring full seating and true alignment of pipe.



WRITE FOR DATA BROCHURE

Fully illustrated literature contains engineering data and installation information. Get it for your files. See *why* there are more TYLOX Gaskets specified for low head service than all other types of gaskets combined. Specify TYLOX Flexible Gaskets for jointing your waste disposal pipe lines.

HAMILTON KENT
MANUFACTURING COMPANY

KENT, OHIO

427 West Grant St.

ORchard 3-9555

CANADIAN PLANT: 10 Brussels St., New Toronto, Ont., Phone CLifford 1-2494

in a considerable increase in property value. The two-plant system provides only primary treatment with separate sludge digestion. Each treatment plant has a reservoir into which the sewage effluent flows by gravity. These reservoirs were found to be necessary for equalizing the load on the irrigation ditches. Both treatment plants are meeting the effluent requirements of the California State Water Pollution Control Board. The water produced is valued at between \$4 and \$8 per acre-foot in the San Joaquin Valley.

"Effluent Grows Crops on Sewer Farm." By T. M. Scott. *Wastes Engineering*, September, 1959.

Dewatering Sludge

Sludge dewatering by vacuum filtration at Cranston, Rhode Island, has been a problem for a number of years due to the fact that a major portion of the plant influent contains troublesome industrial wastes supplying a high organic loading. The over-all effect on the vacuum filters by treating the large volumes of textile wastes has been to in-

crease cake moisture and to decrease cake production. Only through proper digestion and elutriation techniques could the sludge be properly handled on the filters without employing extreme quantities of ferric chloride for conditioning. When the correct techniques are employed, a high solids concentration may be obtained which greatly improves the filter performance. Improved filter operation was obtained first by use of a string discharge filter and dacron napped cloth and secondly by a stainless steel woven Rotobelt. Thus far, however, high production rates have not been obtained by either filter operating on the type of sludge existing at Cranston, R. I.

"Dewatering Sludge." By W. C. Anderson, *Water & Sewage Works*, September, 1959.

Oxidation of Sewage Odors

In the city of Austin, Texas, a 3-million gallon covered sewage holding tank, located in a residential neighborhood, has been provided as a reservoir for untreated sewage to receive excess flow during those hours of the day when the total sewage flow exceeds both the capacity of an existing outfall line and the capacity of the treatment plant. During retention, the sewage is subjected to slow mechanical mixing and to aeration to maintain the solids in suspension and the sewage in a fresh condition. However, during the hot summer season the sewage is not always received in a fresh condition and objectionable concentrations of volatile odorous constituents are released into the surrounding residential area resulting in complaints. The corrective measures employed consist of withdrawing a volume of approximately 1400 CFM of odorous gases into a catalytic combustion unit where the odorous constituents are consumed. The odorous contaminants consisting of a mixture of complex hydrocarbons, mercaptans, amines, and other organics are oxidized to produce end products of water vapor, carbon dioxide and free nitrogen, which are odorless and innocuous. The catalyst is similar in appearance to a metallic air filter mat. It consists of a high nickel alloy crimped ribbon material, packed between similar high nickel container screens, and surrounded by an alloy channel frame. Theoretically, the catalyst has infinite life. In actual operation it is necessary to remove the inorganic dust accumulation on an annual or semi-annual basis.



Revolutionary TRUCK-LODER Frees One Man For Other Sewer-Cleaning Jobs!

The Truck-Loder Bucket Machine brings the deposits direct from the sewer to truck *non-stop!*

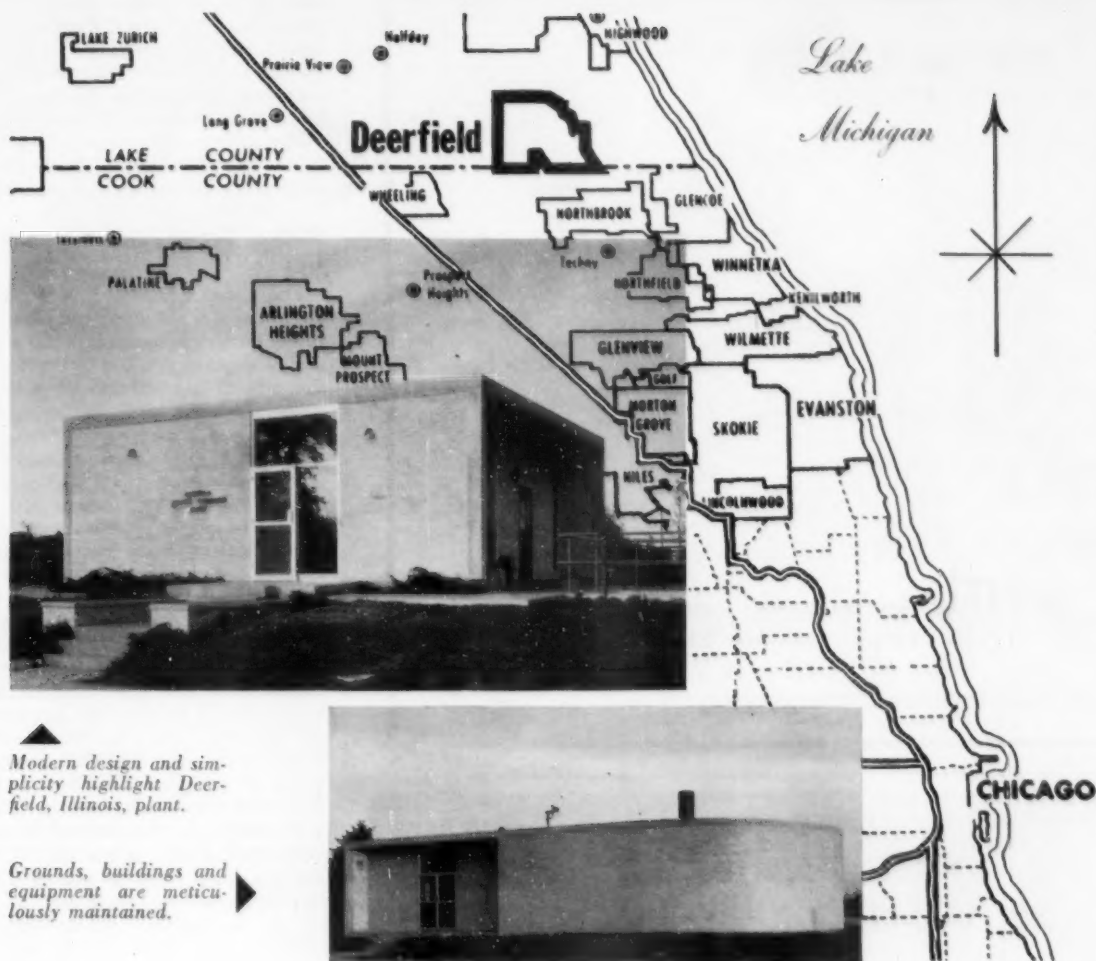
It ends the hard dirty work of manually pulling on the bucket to dump the load; shoveling the deposit from street to truck; and cleaning up the street afterward. It's faster — easier — more sanitary. In other words, it puts an extra man in your Sewer Department at *no extra cost*.

Best of all, you can pair up Truck-Loders with present Bucket Machines and almost triple your sewer cleaning capacity.

To get the full Truck-Loder story, write for the name of your nearest "Flexible" Distributor.

FLEXIBLE INC.

3706 DURANGO AVE., LOS ANGELES 34, CALIF.
1005 SPENCERVILLE ROAD, LIMA, OHIO
415 S. ZANGS BLVD., DALLAS, TEXAS



Modern design and simplicity highlight Deerfield, Illinois, plant.

Grounds, buildings and equipment are meticulously maintained.

Deerfield's Sewage Treatment Plant well prepared for suburban growth

Deerfield, Illinois, is now ready, willing and able to assimilate the tremendous suburban growth in the Chicago area.

Their beautiful new sewage treatment plant is kept in tip-top condition inside and out, reflecting the community's pride in this civic asset.

Just a few years ago Deerfield had a population of several thousand. Their new plant is constructed to serve 7,500 persons and further ex-

pansion can be made most economically.

Baxter and Woodman, Crystal Lake, Illinois, are the Consulting Engineers. They specified the most modern equipment available including P.F.T. Floating Cover, Heater and accessories for complete controlled operation of digester.

Deerfield is one more progressive community providing adequate sewage treatment facilities for their expanding future.

Waste Treatment Equipment
Exclusively since 1893



PACIFIC FLUSH TANK CO.

4241 Ravenswood Avenue
Chicago 13, Illinois

PORT CHESTER, N. Y. • SAN MATEO, CALIF. • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

W E M C O[®] the INCREDIBLE Torque-Flow Pump

pumps almost everything

(what will go in will come out)



secret: recessed impeller; continuous open passage
(with downtime virtually eliminated)

Western Machinery Company 650 Fifth Street • San Francisco, Calif.

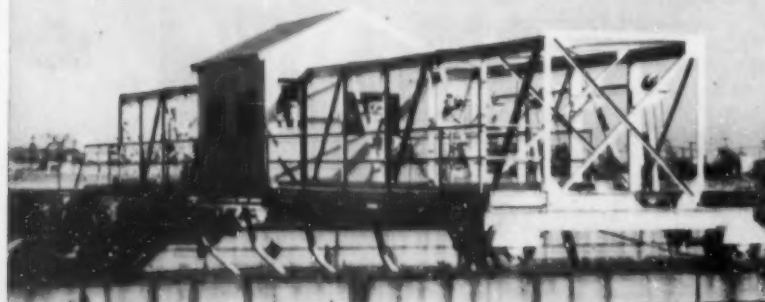
KOMLINE-SANDERSON

RECTANGU-LINE SLUDGE COLLECTORS

• No machinery or mechanical parts under water • Trouble free • Exceptionally low maintenance • Provides sludge scraping and skimming • Self-propelled traveling bridge type structure • Variable speeds attainable • No skewing or crabbing of machine on rails • No cables to pull units.

Another dependable piece of equipment added to the Komline-Sanderson line of quality equipment.

KOMLINE-SANDERSON ENGINEERING CORPORATION
PEAPACK, NEW JERSEY



Although several thousand industrial applications of this process are now in use in a wide variety of applications, this is the first installation furnishing primary design information for destruction of odorous contaminants in other problems related to the sewerage system.

"Oxidation of Sewage Odors." By A. H. Ullrich and R. J. Ruff. *Water & Sewage Works*, September, 1959.

Sludge Gas Utilization

The City of Durham, N. C., now operates five sludge gas engines utilizing the gas evolved in the process of digesting waste solids. With the original installation of two engines made in 1933, the engineers have gained considerable design and operating experience concerning sludge gas utilization. The author has presented a very comprehensive discussion of the various phases of this problem. In the past, economic factors have been the principal concern, and though they are still important, the author emphasizes that other factors must be given equal or superior weight. The most important engineering and legal consideration today should be absolute continuity of required waste treatment with breakdowns and power failures a thing of the past. The author has discussed the various factors having a bearing upon the composition and volume of sludge gas produced, the gas collection and storage facilities, minimum safety measures which should be observed, sludge digester heating and recirculating equipment, various uses of the gas produced, types of sludge gas engines in use and the advantages or disadvantage of each type. In addition, he has discussed the various factors in the heat drying and/or incineration of digested sludge, the control instrumentation applicable to sludge gas utilization and the analytical instruments used for the determination of sludge gas quality. In conclusion, the author states that continuity of effective treatment is today the most important consideration involved in deciding whether to utilize sludge gas to back up outside sources of power.

"Sludge Gas Utilization." By Wade G. Brown. *PUBLIC WORKS*, October, 1959.

Other Articles

"Effects of Impoundments on Dissolved Oxygen Resources." This discussion deals with one of the undesirable results of impoundment, its effect on dissolved oxygen re-



Air view of new secondary treatment facilities at Wichita, Kansas. Two 205 ft. dia. final basins, with Eimco-Process Clarifier mechanisms, have been completed and the third unit (lower left) is under construction. Consulting Engineers—Black & Veatch, Kansas City, Missouri.

WICHITA CHOOSES EIMCO-PROCESS EQUIPMENT FOR THIRD TIME

Repeat orders are a prime goal of nearly all businessmen, including those who manufacture sewage treatment equipment, and that is why we are proud to have been selected for the third time to supply clarifier mechanisms to the City of Wichita.

In 1954, two 125 ft. dia. Eimco-Process Type C Clarifiers were installed in the primary plant. Two 205 ft. dia. units, among the largest in the country, were purchased for the new secondary treatment works in 1958 and construction has now begun on

another 205 ft. final clarifier and a 180 ft. primary unit as part of an expansion program that will raise the plant's capacity to 75 mgd.

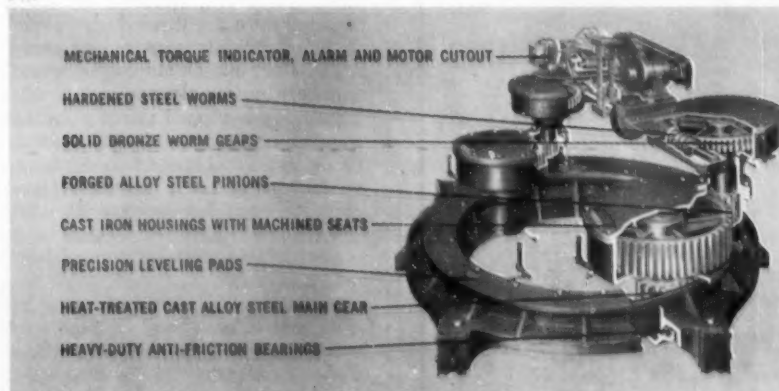
There are good reasons for a customer to place repeat orders: excellence of equipment design, quality fabrication, thorough field service . . . plus that intangible "know-how". We would like to apply our years' of experience to *your* problem and earn your confidence, too. As a start, may we send you a copy of our new Bulletin SM-1005, "Eimco-Process Clarifiers and Oxidators®"?

THE EIMCO CORPORATION



Process Engineers, Inc. Division
420 Peninsular Avenue, San Mateo, California

0-523



MECHANICAL TORQUE INDICATOR, ALARM AND MOTOR CUTOFF

HARDENED STEEL WORMS

SOLID BRONZE WORM GEARS

FORGED ALLOY STEEL PINIONS

CAST IRON HOUSINGS WITH MACHINED SEATS

PRECISION LEVELING PADS

HEAT-TREATED CAST ALLOY STEEL MAIN GEAR

HEAVY-DUTY ANTI-FRICTION BEARINGS

Heavy-duty balanced driveheads with multiple pinions efficiently handle the extreme torques encountered in the operation of the large Wichita clarifier mechanisms. All Eimco-Process drive units are custom fabricated in the Eimco shops.

sources, which in turn may cause decreased pollution assimilation capacity of the water. By F. W. Kittrell. Sewage and Industrial Wastes, September, 1959.

"Sewer Slimes Cause Odors!" Experiments at University of Oklahoma show how low flows in sewers stimulate slime growths and cause odor conditions. By G. W. Reid and T. S. Yang. Wastes Engineering, September, 1959.

"Wastewater Treatment in England and Holland." Prof. Bloodgood reports on his observations of several wastewater treatment installations in these two countries. By Don

Bloodgood. Water & Sewage Works, September, 1959.

"A Field Study of Contact Aeration." A report on the results of a field study of four contact aeration sewage treatment plants in Texas. By Ernest W. Steel. Public Works, October, 1959.

"A New Incinerator Gives Complete Fly-Ash Control." The Belmont, Massachusetts, new 150-ton capacity incinerator has several unique features. Public Works, October, 1959.

"Pipe Laying and Jointing. This is the third installment in a continuing series on construction super-

vision. This installment covers the laying and jointing of all types of pipe used for water and sewage. By Leo J. Ritter, Jr. Water & Sewage Works, September, 1959.

• • •

Many Cities Use Special Truck Bodies

In a questionnaire sent to City Engineers in early 1959, information was requested on specially designed and equipped truck bodies used for survey work, for sewer cleaning and repair and for street patching. A total of 1563 questionnaires were returned and of these 605 reported using specially designed and/or equipped bodies, not only for the purposes listed above but also for water department, electric utility, traffic and lighting, park and forestry work and other purposes.

The number of such specially equipped trucks was not asked for and the figures above and those given below are for number of cities reporting and not for number of units. In addition, a complication arose in determining what was meant by the term "utility." This could mean a utility type truck used by the water department, or a special design of truck body to suit it to water utility work. In each case, careful consideration was given to the accompanying data on the questionnaire as an aid in determining exactly what was intended by our readers.

The 605 cities reporting listed 130 trucks and bodies specially designed for survey crew use. Presumably these have seating arrangements for the normal survey crew and space to carry rods, chains, tapes, levels and transits and, in some cases, additional equipment.

Nearly half, a total of 287, reported having specially designed and equipped trucks for sewer maintenance work. It is believed the units reported here are those designed for minor complaints, repairs and stoppages, since major stoppages would require a power cleaner.

Specially equipped street patching units were reported by 190 cities. These appear to range from pick-up trucks having some special equipment, through heavier trucks with asphalt and aggregate storage and a small paving mixer mounted or towed, to trains of several units.

A number of cities volunteered additional information. Special water department or water utility trucks were reported by 60 cities; electric utility trucks by 71 cities;

*When it comes to your bucket jobs come to **O'Brien!***

See the all-power sewerking BUCKET MACHINE for 1960!



READY NOW—the revolutionary Bucket Cleaner that completely removes sand, big roots and other heavy sewer obstructions as never before! Built extra heavy, strong and safe—important automatic features for easy operation—greater power, pull and capacity to clean more sewer at lower cost!

ASK FOR INFORMATION ON THE NEW SEWERKING BUCKET DUMPER

WRITE, WIRE OR PHONE TODAY FOR FULL INFORMATION —without obligation!

AVAILABLE IN 9-16-25 HP.

**NATIONWIDE SALES AND SERVICE
PHONE RODney 3-7433**

O'Brien MANUFACTURING CORPORATION
Dept. PW 1159 • 5632 Northwest Highway, Chicago 46, Illinois

units used by both water and electrical departments 9; traffic and lighting units 31; and combined water and sewer departments 4.

Some special and interesting equipment was reported, including Civil Defense rescue trucks, dead animal collection units, pest control trucks, units for cleaning catch basins and mosquito spray trucks.

Leaf pick-up units are popular in the East and were reported by a number of communities. Other reports covered a truck for bridge maintenance, a closed body chipper unit, and a truck designed to haul sewage sludge to a landfill.

South Dakota Water and Sewage Works Conference

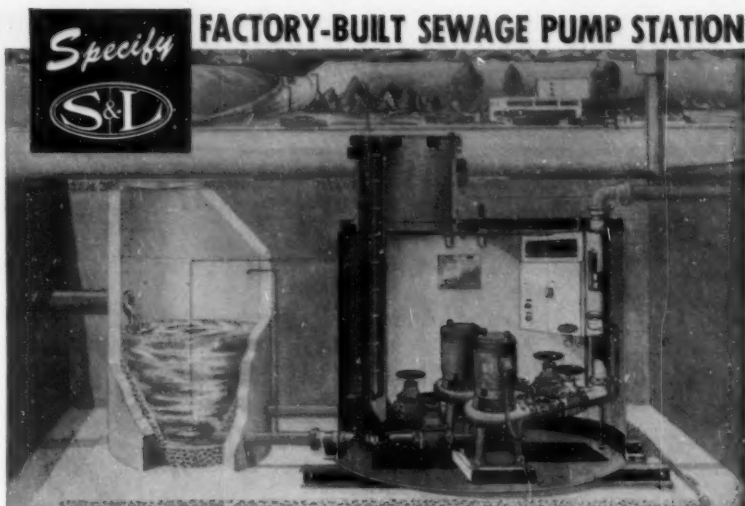
The Twenty-Fifth Annual Meeting of the South Dakota Water and Sewage Works Conference was held at Huron, Sept. 2-4. Registration for the meeting totaled 166, including water and sewage works operators, municipal officials, commercial representatives, State and Federal personnel and guests.

The technical program started with a "History of the Conference" by W. W. Towne, Public Health Service. This was followed by a discussion on "Federation of Sewage and Industrial Wastes Associations—Past, Present and Future," by Kenneth W. Watson, Past President of the FSIWA. Afternoon papers included: "American Water Works Association—Past, Present and Future," by Lauren W. Grayson, President, AWWA; "Radioactive Wastes—A New Problem," by Everett R. Mathews of the Atomic Energy Commission; and "Water Well Stimulation," by Louis Koenig.

Mayor R. B. Matson of Huron was toastmaster at the Annual Banquet. The Izaak Walton League Award went to Frank Thomas, sewage treatment plant operator at Custer, and the Flox Company Awards to Erwin Wollman, Freeman, and James Cox, Sioux Falls.

Longevity awards went to Carl Dahlund, Sioux Falls; E. R. S. McGillycuddy, Elk Point; A. I. Olding, Redfield; H. B. Dickerson, Sisseton; W. P. Wells, Aberdeen; C. P. Wyman, Sioux Falls; and James A. Cox, Sioux Falls.

At the annual business meeting officers were elected as follows: President: Byron Fees, Chamberlain; Vice-President, W. Dale Mailoux, Rapid City; Secretary-Treasurer, Don C. Kalda, Pierre; Directors: F. S. Dixon, J. A. Zahn, Ray Jorgenson, Donald Sears, Darrell French and J. N. Dornbush.



Over 1,000 installations from coast-to-coast, including Alaska and Canada prove the merit of specifying Smith & Loveless Factory-Built sewage pump stations . . . America's finest! The compact, easy-to-maintain Smith & Loveless pump station is economical, efficient and manufactured of the finest materials. It is easily and quickly installed following

delivery to the job site on special Smith & Loveless trucks.

Smith & Loveless offers a complete line of lift stations with capacities from 20 GPM to 4800 GPM.

For job recommendations, complete specifications and drawings write today for our free, 100-page data manual on pump stations and pneumatic ejector lift stations. Write Department 49

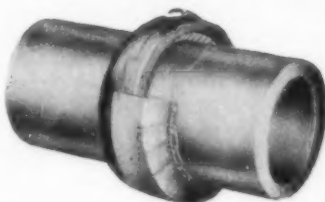
By the makers of America's finest factory-built sewage treatment plants.



Smith & Loveless, Inc.

P.O. BOX 8884 • KANSAS CITY 15, MISSOURI
Representatives in principal cities

BUILD BETTER SEWER LINES



with
**WESTON
GASKETS and FORMS**
for
SEWER PIPE JOINTS
(a cement joint)

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON CO.

Adams Mass.

HEAVY-DUTY ELLIS PIPE CUTTER FOR CUTTING LARGE SIZE PIPE

Drop-Forged
Frame
and Links

Long-Lasting
Cutter
Wheels

Makes
a Hit
With
Water
Works
Men



Cuts
Pipe
In or Out
of
Ditch

TWO SIZES

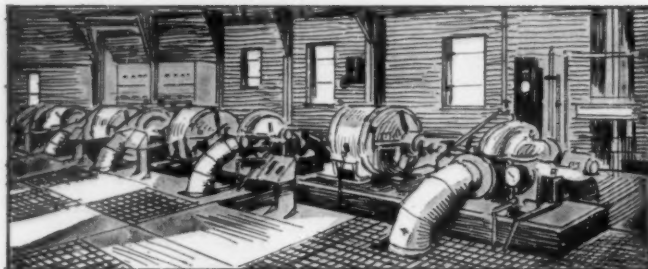
No. 01 for 4" to 8" Pipe
No. 1 for 4" to 12" Pipe

Write for Circular
and Price List No. 41PW

ELLIS & FORD MFG. CO.

P. O. BOX 308
BIRMINGHAM, MICHIGAN

THE WATER WORKS DIGEST



Prepared by ALVIN R. JACOBSON, Ph. D.

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Iron and Manganese Removal

Three new wells and the construction of two new iron and manganese removal plants at Lake Charles, La., will provide an additional treated water supply of 8.5 mgd. The construction consisted of 1) the installation of a 1500-gpm well and treatment plant at the Center Street site; 2) the installation of an additional 1500-gpm well and treatment facilities at the Center Street site for a total capacity of 3,000 gpm; and 3) the installation of a 3,000-gpm well and treatment plant at the McNeese Street site. The treatment method at both plants provides for atmospheric aeration, chlorination, copper (copper sulfate) introduction as an oxidation catalyst for manganese removal, ammonia feed, one hour detention, pressure filtration and alkali feed for pH correction. The pretreated water at each site is filtered through two 10-ft. diameter x 62 ft. long three-cell, horizontal multicell filters. The pumping control is fully automatic together as is automatic control of

the backwashing operations. The backwashing operation is accomplished by a pressure differential indicator-recorder controller which initiates a timer-controlled backwashing cycle to backwash each filter cell and return it to operation in proper sequence until all 6 cells have been backwashed.

"Iron and Manganese Removal at Lake Charles, La." By George West. *Water & Sewage Works*, September, 1959.

Corrosion Inhibition

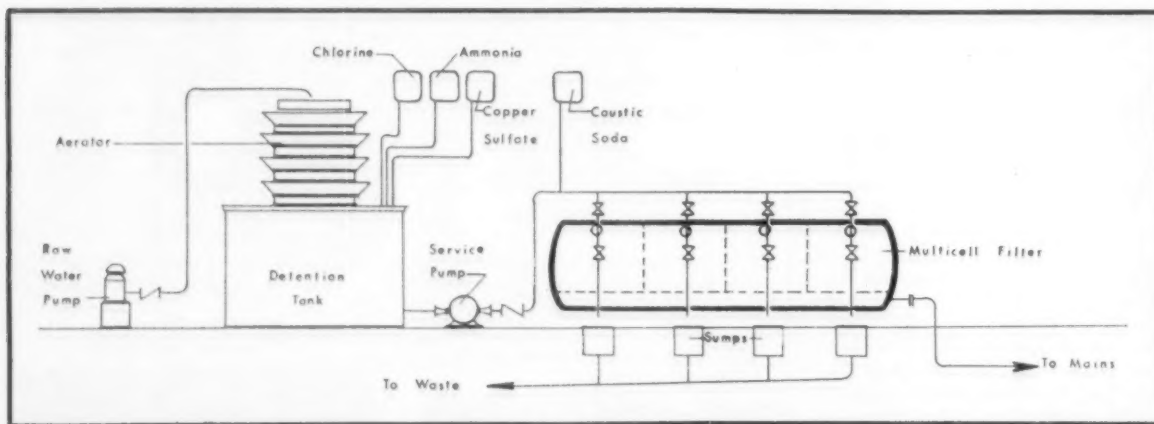
Corrosion of steel specimens by cooling water can be inhibited through the use of sodium nitrite. If, however, a sufficient concentration of sodium nitrite is not maintained, or if the pH value of the cooling water becomes too low, a high rate of localized corrosion can occur. This is the conclusion of the authors resulting from a series of tests made for the purpose of evaluating this inhibitor alone and when a combination of sodium nitrite, zinc sulfate and polyphosphate was used.

Zinc sulfate and polyphosphate perform synergistically with sodium nitrite as corrosion inhibitors to halt corrosion almost completely right from the start. The action of zinc sulfate and polyphosphate in helping the sodium nitrite permits the use of reduced concentrations of sodium nitrite.

"Corrosion Inhibition With Sodium Nitrite." By J. Beecher, C. Dinkel, and S. Corwin. *Journal A. W. W. A.*, September, 1959.

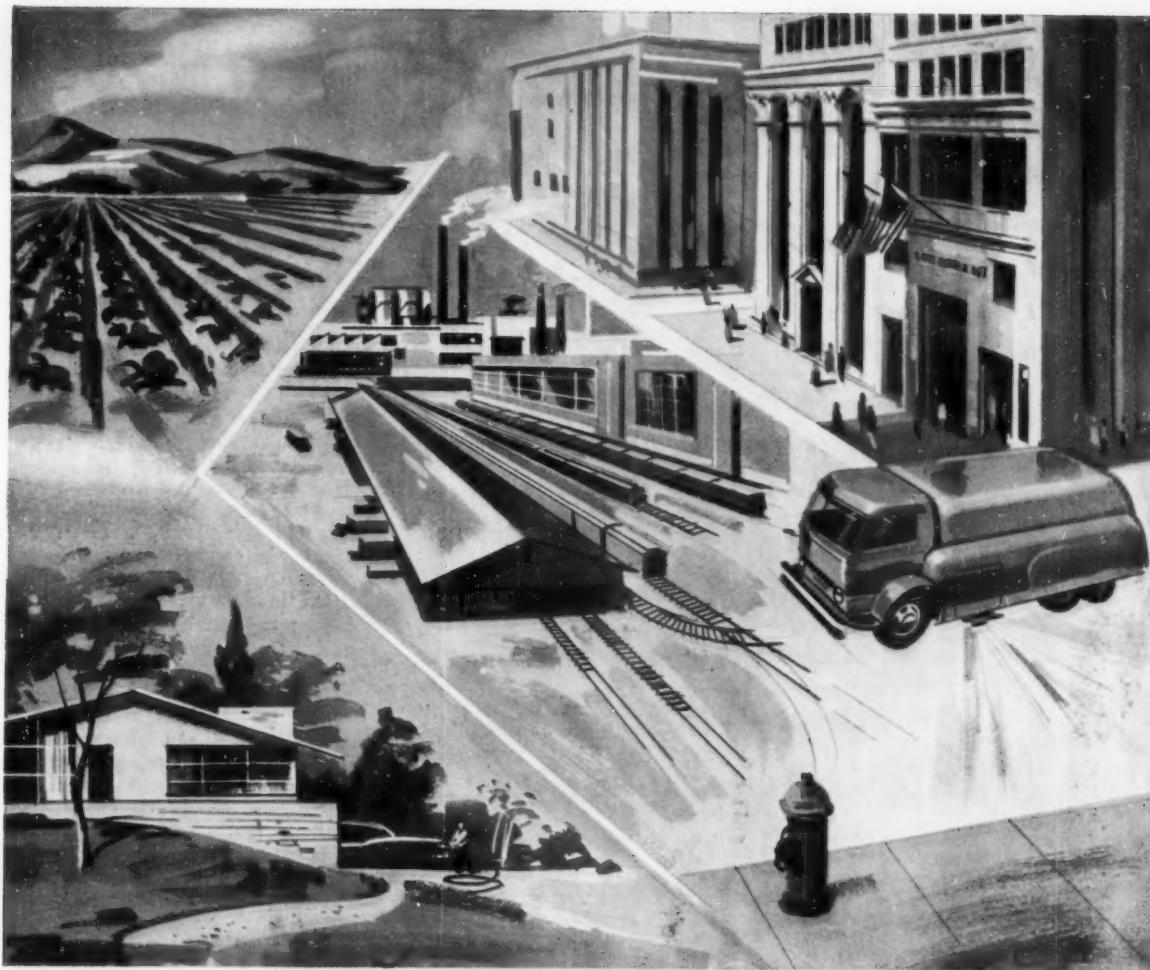
Bond Issue Campaigns

With the increasing population of the United States and the consequent increasing need for more and more capital facilities, which, in turn, require more bond financing, the subject of bond issue campaigns is a most timely one. In this article the author discusses some of the fundamental principles and generally accepted techniques of planning a successful bond campaign. Because examples of practical applications are usually helpful, the discussion refers to the successful



Courtesy Water and Sewage Works

● FLOW DIAGRAM for the 3000 gpm capacity iron and manganese removal plant installed at Lake Charles, Louisiana.



Lock Joint serves your community best

... IN THE HOME

INDUSTRY

AGRICULTURE

FIRE PROTECTION

SANITATION

An adequate supply of water, and an efficient means of disposing of excess water and wastes, are two of the most vital necessities to the comfort, health and growth of any community. LOCK JOINT CONCRETE PIPE provides the ideal material for implementing these important services. Dependable, rugged and economical, Lock Joint concrete pressure pipe, and sewer and culvert pipe will give trouble-free service for generations with the very minimum of maintenance requirements.

The large variety of designs available in Lock Joint Concrete Pipe make it possible to select the most economical pipe consistent with the specific requirements of any individual project, whether the pipeline be for water supply, water distribution, drainage, sewage or subaqueous installation.



LOCK JOINT PIPE CO.

East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo. • Perryman, Md. • St. Paul, Minn.

Pressure • Water • Sewer • **REINFORCED CONCRETE PIPE** • Culvert • Subaqueous

\$252,000,000 bond election held in June 1958 at the East Bay Municipal Utility District, Oakland, California, to finance a 10-year construction program needed to meet the growing water needs of the East Bay area. The subject of bond campaigns divides itself logically into four areas of discussion: 1) Planning for a bond issue election; 2) organization of the campaign; 3) conduct of the campaign; and 4) follow-up after the election. The author discusses each of these four areas in detail including the part the public agencies, as well as, citizen groups

may play in carrying out a successful bond campaign. The citizens of Oakland approved the \$252 million bond issue by more than 3½ to 1, indicating an effective campaign.

"Mechanics of Bond Issue Campaigns." By F. H. Eastman. *Journal A. W. W. A.*, September, 1959.

Kansas City Doubles Capacity

The present expansion program will double the water supply capacity of Kansas City with only a 50% increase in the size of the physical

plant being necessary. The original 100-mgd capacity plant which was constructed in 1924-27 and produced settled, filtered, and chlorinated water was modified in 1941 to provide for softening by the lime-soda ash process. In 1952 construction was begun on the current expansion and modernization program. Two presedimentation basins were added to the four that already existed. Open flumes were provided to replace the original conduit which had a capacity of only 100 mgd. A final (stabilization) basin was added to supplement the two original square tanks. Included in this program were 12 new filters and a 7,000,000 gallon clearwell at the treatment plant. Chemical storage and feeding capacities were doubled and new research laboratory facilities were provided. Other units were also increased in capacity. Recarbonation basins were installed. Stabilization of the lime-softened water is provided to prevent encrustation of the sand grains in the rapid sand filters. The new filters are equipped with surface wash, and a much higher rate of backwash is provided than originally. The new clearwell provides 7,000,000 gallons storage capacity at the treatment plant permitting greater flexibility between treatment rates and pumping rates. Installation of new high-head pumps that deliver almost twice as much water through a 90-inch tunnel across the Missouri River has proved much less costly than drilling another tunnel under the river or laying additional mains across the river. Three central control stations are provided at the water plant. One is for control of all pumps in the Kansas City North area, another is for control of the water treatment processes, and the third controls filtration rates. By following a master plan of construction and letting contracts in the order of their value in eliminating "bottle-necks" in the treatment process, the water department officials of Kansas City are seeing their efforts begin to pay dividends in improved service.

"50% Expansion Doubles Capacity." By G. E. Hands. *The American City*, September, 1959.

Electronic Control System

A new \$100,000 centralized electronic data telemetering and recording system is helping Milwaukee get the most out of its present water utility system. The new information system measures 27 critical pressures, flows and water storage lev-



A CUP OF WATER

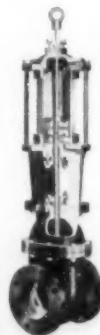
"'Tis a little thing," the poet says, "to give a cup of water." Yet water, an absolute necessity even in the most primitive society, has had to be rationed in over 1,000 prosperous U. S. communities in the past 5 years. Rainfall has been normal. But water use has increased much faster than improvements in water distribution facilities. Suburban development means more footage of water main per customer.

Some 60% of the water utilities in prosperous U. S. need major improvements now in their distribution systems. For the next 20 year period the U. S. Department of Commerce estimates water works and sewerage works construction requirements at over \$41 billion, which is about equal to the total estimated replacement value of existing facilities. This will require construction expenditures at approximately double the current rate.

So, "to give a cup of water" in these modern times has ceased to be a little thing. Your water works superintendent knows the technical side of the problem. But he needs the moral support of his water consumers.

This series is an attempt to put into words some appreciation of the water works men of the United States.

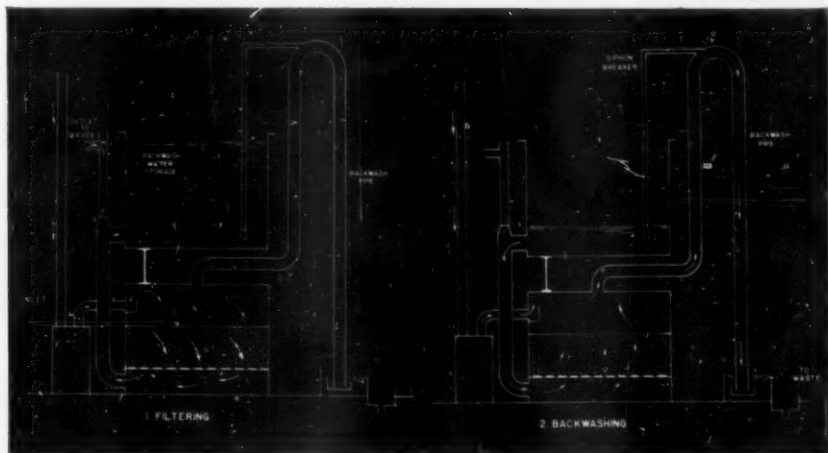
M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA



FLUIDICS

is a Pfaudler Permutit program providing
the know-how
the equipment
and the experience
for solving problems involving fluids

Permutit valveless filter, municipal design



FLUIDICS covers such varied phases of fluid handling and control as:

- corrosioneering
- water treatment
- waste treatment
- fluid analysis
- agitation
- blending
- metering
- valving
- flow rate control
- piping
- storing
- heat transfer
- pumping

Whenever you have a fluid-handling problem, put the Pfaudler Permutit FLUIDICS program to work.

**PFAUDLER
PERMUTIT
INC.**

Specialists in FLUIDICS . . .
the science of fluid processes

FLUIDICS AT WORK

The only filter that works by itself

We sell most of our Permutit valveless filters simply by pointing out the things you *don't* have to do and the things you *don't* need once you install one:

Manpower—None needed. No valves to operate, gauges to watch, pumps to start or stop, or decisions to be made.

Valves—None. Entire operation is automatic and hydraulic.

Pumps—None needed. All work done by atmospheric pressure.

Rotary wash—None needed. Unit operates only to four- or five-foot head . . . schmutzdecke cannot become packed enough to need breaking up.

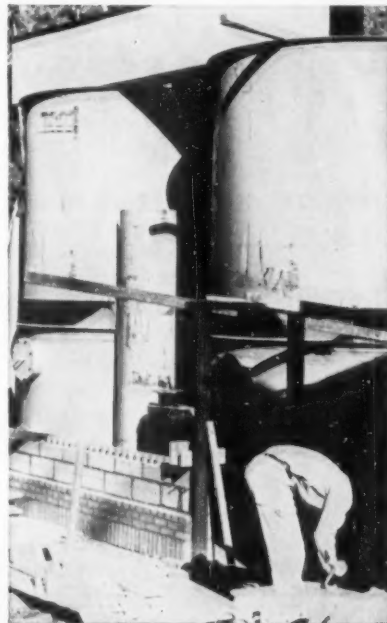
Flow controller—No mechanical, pneumatic, or hydraulic devices needed . . . unit filters whatever volume you deliver.

Maintenance — None, outside of normal, routine painting. No moving parts to wear out.

The best part of our story is the fact that this filter costs less than conventional gravity filters, either manual or automatic.

The basic laws of hydraulics behind this filter's design show in the diagrams. If you're rusty on your hydraulics, or are just plain interested, we invite you to write for our bulletin on valveless filters.

Address yourself to our Permutit Division, Department PW-119, 50 West 44th Street, New York 36, New York.



Automatic valveless gravity filters, like this tandem setup photographed during its installation at an Eastern municipality, are now in service.

els at 12 widely-separated stations, telemeters the information over telephone lines to a central Operations Center and records it automatically by typewriter. It is the first such automatic recording system to go into operation in a water utility in the U. S. The Fischer & Porter telemetering and data recording system consists of: a) The necessary transducing instruments to measure, indicate and/or record locally and to retransmit flow, level and pressure values; b) the telemetering facilities for distant transmission and reception of these signals over telephone lines; and c)

the data recording equipment required to convert and record these signals in digital form (typewritten log sheets). The four basic types of Fischer and Porter instruments used in the Water Works System at Milwaukee are: 1) V/A Cell Ori-Flowrators; 2) Flow Totalizing Transmitters; 3) Level and Pressure Transducers and Flow Transmitters, and 4) Mercury Manometer Flow Indicating Transmitters. The choice of instruments was based on tests for accuracy, simplicity, and economy—in that order. The big advantage of the new information system is that it provides a centralized,

simultaneous record of all critical points in the Milwaukee water system so that the water works officials now are alerted almost immediately and can take corrective action when necessary.

"Electronic Information System Provides Centralized Records and Operational Control." By Alan L. Vink. *PUBLIC WORKS*, October, 1959.

Erie County's Control Center

The Erie County Water Authority in Western New York has found that rapid automatic instrumentation and control of its system is the means for eliminating poor service due to "low pressure" or "no water" which previously resulted in numerous complaints. The key to this effective service is a new operations center. The entire network of pumping stations and the system's storage facility are under the surveillance and supervision of the control operator. A leased pair of telephone wires from each remote pumping station and storage facility to the control center, informs the operator of the complete status of the remote facilities. This includes data on flow rates, suction and discharge pressures, and water levels in storage, all transmitted through a telemetering network. It is now possible to keep the system in balance hydraulically, in spite of periodically heavy demands in various areas. The water produced by the authority's water treatment plant is augmented with the City of Buffalo supply. In addition, a new treatment plant and pumping station, with an initial capacity of 16 mgd is now under construction.

"How to Avoid Low Pressures and No Water Complaints." By R. J. Weisbeck. *Water Works Engineering*, September, 1959.

Other Articles

"The Jar Test: Its Use." This last in a series of three articles on coagulation is concerned with evaluating the conditions of floc formation and the adjustment of chemical dosages to effect good coagulation and sedimentation. By Marvin Lane. *Water and Sewage Works*, September, 1959.

"Minford Silt and Ground Water Quality in Western Ohio." A hypothesis is presented, which if later proved to be correct, indicates that the Minford silt deposit may be selected as future sites for the development of industrial and municipal wells. By Stanley E. Norris. *Journal A. W. W. A.*, September, 1959.

Dicalite Filtration

...answers all
5 questions
on municipal
water supply

CLARITY... No longer any question on this point. The records of municipal filter stations operating with Dicalite Filteraids prove that, day after day, turbidity in filtered water is easily held to 0.5 ppm or below.

CAPITAL INVESTMENT... From 20% to 35% lower for a diatomite filter system than for a rapid sand system of equal capacity. This is based both on expert engineering estimates and on comparisons of actual costs where all other factors were equal.

OPERATING COST... For all practical purposes, diatomite and rapid sand show equal operating costs on the basis of time, labor, operating supplies and power.

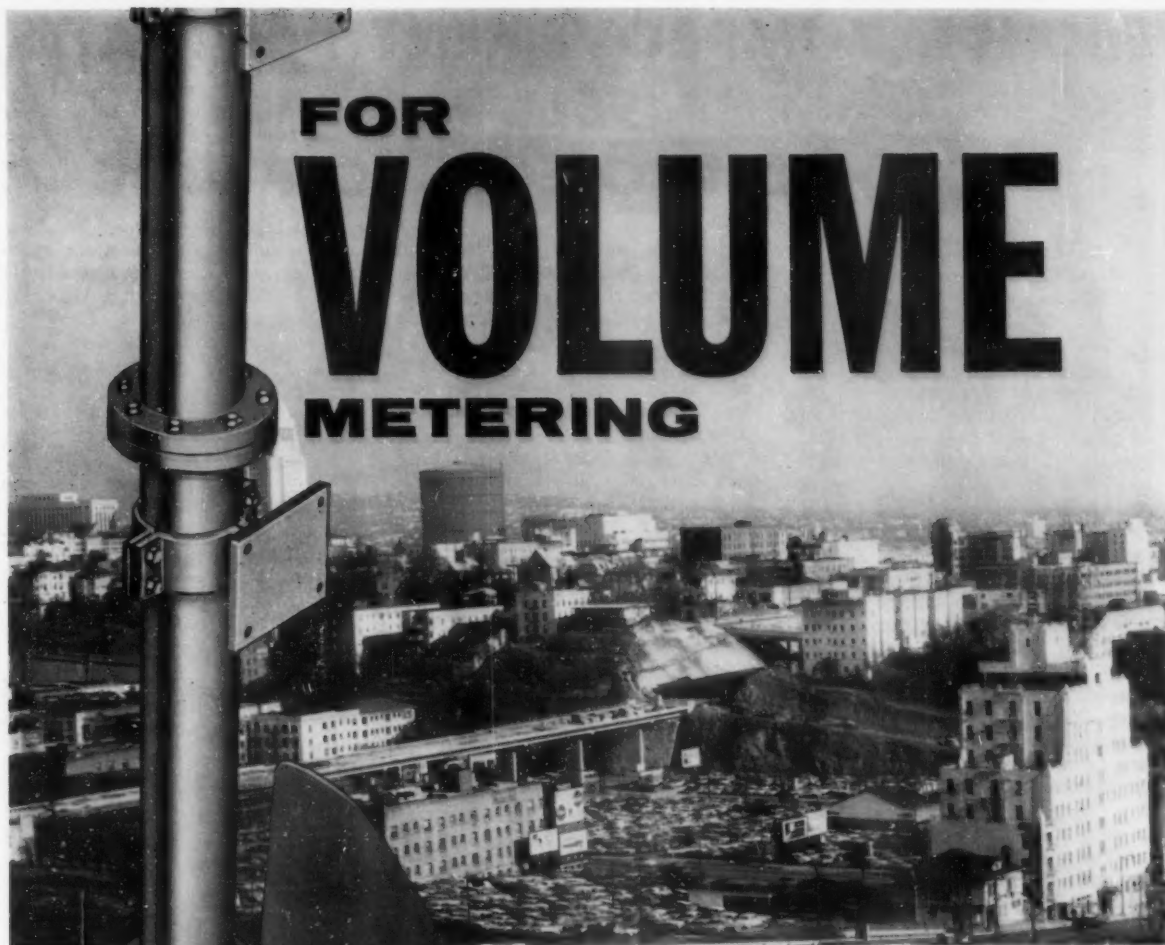
SPACE REQUIREMENTS... For each square foot required for a diatomite system, you will need at least 4 square feet for a rapid sand system. The tremendous advantage of diatomite filtration on this point is obvious.

PERSONNEL... With today's highly developed diatomite filter systems—automatic or semi-automatic in operation—semi-skilled labor can operate them (and are operating them!) with as little as 1 or 2 hours per day labor time. The constant attention of skilled technicians is *not* required.

Write us—today—for the informative and factual Dicalite Bulletin BW-13.

Dependable
GLC
Dicalite
DIATOMACEOUS MATERIALS

DICALITE DEPARTMENT, Great Lakes Carbon Corporation • 612 So. Flower St., Los Angeles 17, Calif.



FOR VOLUME METERING

SPARLING WATERWORKS INTAKE METER

Wherever there are large volumes of water to be measured, this versatile meter provides greater control, increased efficiency and the opportunity for more exacting chemical feed. It accurately totalizes flows through closed conduits, inverted syphons, into reservoirs, and at many otherwise unmeasurable points. Negligible head loss makes it ideal for gravity flow systems. Installation is simple. Most perpendicular headwalls or similar structures are suitable, and the meter may be installed, removed, or inspected without interrupting service. Currently used in lines as large as 19' in diameter and can be utilized for even larger sizes.

Call your Sparling representative for complete details, or write for bulletin CF-239-1

6-DIGIT
STRAIGHT-READING
TOTALIZER.

SIMPLE MOUNTING
BRACKETS.

POLYETHYLENE OR
STAINLESS PROPELLER.

SPARLING
WATER CONTROL EQUIPMENT

SPARLING METER COMPANY 225 N. Temple City Blvd., El Monte, California

Atlanta 3 • Chicago 4 • Cleveland 13 • Dallas 1, Tex. • Denver 6 • Kansas City 6, Mo. • Roselle, N. J. • San Francisco 24 • Seattle 99 • Romford, England
United Kingdom Affiliate: TYLORS OF LONDON LTD.

HIGHWAY IMPROVEMENT PORTRAITS SELL PROPOSED PROJECTS TO PUBLIC

CLIFF HUTCHINSON

Public Information Assistant,
Wisconsin Highway Commission

HIGHWAY PORTRAITS done in oil are Wisconsin's latest and most effective weapon for winning public understanding and acceptance of proposed road improvement projects. Believed to be the first of their kind used in highway work in the nation, the king-sized oil paintings show more accurately than any other tool thus far used, the general plan, as well as the smallest details, of planned improvements.

Originally, state highway officials depended on showing blue prints and similar engineering data to local government officials, property owners, service clubs and others affected when plans for proposed improvements were announced. At formal public hearings a set of plans was formerly the main, and frequently the only, visual tool. Since most laymen and many county, town and city officials are not trained to read or interpret blue prints, misimpressions, or no impressions at all, were common.

L. W. Empey, Commission District Engineer at Green Bay, recognized the need for a practical and easy-to-grasp visual device for public information. He asked his staff artist, Reynhold (Fritz) Schenkelberg, to rough out an oil sketch of a proposed road relocation and Schenkelberg, whose only formal art training was gleaned in Green Bay high school art class, produced the painting shown in the accompanying illustrations.

Engineer Schenkelberg had previously created a dozen or more useful 3-dimensional scale models of proposed road improvements. These were extremely effective as visual aids at public hearings and in talks before civic groups but they were heavy, awkward to transport and lacked the small details easily depicted in paintings.

"We notice a lot more understanding among the people in the areas to be affected by the improve-

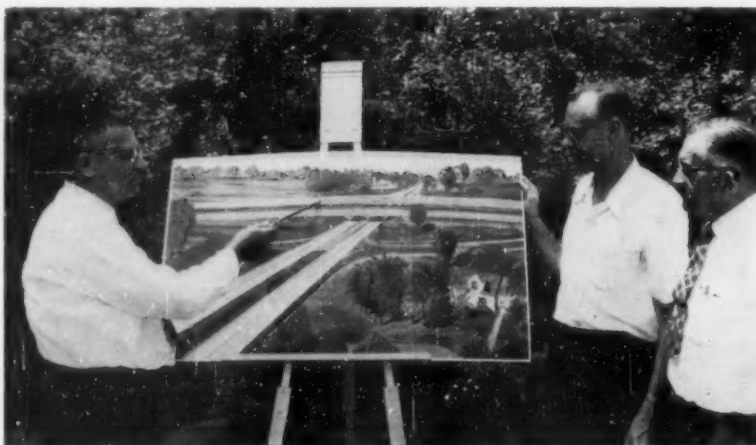
ment after we've shown them the paintings," Empey said. "They see exactly how things are going to be after the project is completed and they are genuinely satisfied. The older methods we used left them with many questions—now we seldom have any queries after they've seen the paintings."

It's a little difficult when looking at a blue print to visualize what a bridge will look like when it is finished or to know whether the approaches to an interchange will leave standing someone's favorite row of elm trees. And it's hard to tell whether the sweeping curve in the new highway will need the space

now occupied by the barn, the milkshed or even the farm home itself.

Schenkelberg's paintings now give the whole picture with simple accuracy, overcoming the problems of reading the blue print and eliminating the difficulties of carrying bulky scale models to and from public hearings and meetings.

Producing paintings of this type requires a special talent since the highway improvement is actually only in the proposed form. Mr. Schenkelberg is able to create an accurate picture far ahead of time from studying the plans and specifications and visiting the area where the improvement is to take place.



● OIL PAINTING shows proposed highway improvements in detail. The Wisconsin State Highway Commission finds that paintings are effective for public relations.

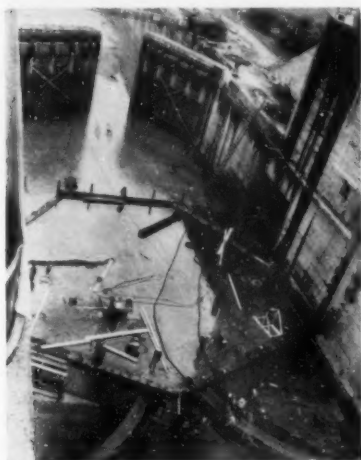


● WISCONSIN'S Artist-Engineer Reynhold Schenkelberg at work on a typical picture of new highway plans.

Submersible Pumps Dewater Canal Lock

DURING a summer weekend a broken timber sill in Lock No. 4 caused the closure of the Welland canal, only water link between Lake Ontario and Lake Erie and a vital part of the St. Lawrence Seaway. An immediate concern was to pump the area around the lock dry as

soon as possible to enable workmen to start repairs. For this purpose one 8" and eight 3" FLYGT electric submersible pumps were rushed to Lock No. 4 by G. F. Seeley and Son Limited, Toronto, Ont., construction equipment dealer. These pumps, which require no platform or installation, were put to work without delay and completed the necessary pumping in a little over an hour. FLYGT pumps are distributed in the U. S. by Stenberg Manufacturing Corporation, Hoosick Falls, N.Y.



● LOCK of the Welland Canal dewatered for repairs to broken sill.



● APPLICATION of fast-setting "Catatherm" traffic stripe markings.

Thermoplastic Road Striping Material by Cataphote

A NEW thermoplastic striping material called Catatherm is being used by the State of Illinois. A contract for laying such markings on 84.83 miles of heavily traveled urban roadways was let to the Cataphote Corp. on a low bid of \$126,669.

Application was by a unique all-operation-in-one striping machine which moved at a steady 2 to 4-mile rate down the center of crowded four-lane U. S. 30, working in 40-

foot cycles—striping 15 feet and skipping 25. The material lasts many times as long as paint, gives maximum reflection throughout its life, dries quickly and does not smear.

PALMER

FILTER BED AGITATORS

TECHNICAL ADVANTAGES

- 1—Requires an average of 40% less wash water
- 2—Completely eliminates mud balls
- 3—Eliminates cracking or shrinking of the beds
- 4—Produces "new" filter media after short period of normal operation
- 5—Turns out purer, better tasting water
- 6—Low installation cost
- 7—Low operating cost
- 8—More water through the filters
- 9—Less "time out" washing filters

PALMER

ANTHRAFILT FILTER MEDIA

FAR SUPERIOR to Sand or Quartz Media, as it Double length of Filter runs, nearly halves wash water needs; with less coating, caking, or balling.

Filters are in service more as wash water cycle shorter. Better removal of bacteria, taste, odor. Increased Filter output, better effluent. Ideal for industrial acid and Alkaline solutions. Ask any user.

PALMER FILTER EQUIPMENT CO.

822 E. 8th St. • Erie, Pa.

APCO Super De Lavaud CAST IRON PIPE

In sizes 3" to 24" in modern long lengths. Bell and spigot, roll-on-joint and mechanical joint.

For water, gas and sewage.



For The Best Connection You'll Ever Make Investigate The New ALTITE JOINT® by APCO

Underwriters Approved Patent Applied For.



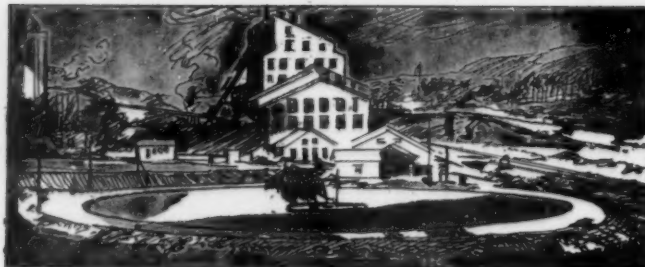
ALABAMA PIPE COMPANY

General Offices—ANNISTON, ALABAMA

SALES OFFICES

122 South Michigan Ave., Chicago 3, Ill.
350 Fifth Ave., New York 1, N. Y.
905 1006 Grand Ave., Kansas City, Mo.
18505 W. Eight Mile Rd., Detroit 41, Mich.
5335 Southern Ave., South Gate, Calif.

THE INDUSTRIAL WASTE DIGEST



Prepared by CLAYTON H. BILLINGS, Associate Editor

Cyanide Wastes Instrumentation

The Micro Switch Division of Minneapolis-Honeywell Regulator Co. began to encounter cyanide waste treatment problems when, in addition to enlarging plating activities, it began making mercury switches at its Freeport, Ill., plant. Originally the waste treatment plant included a fixed-flow chlorinator, pH recorders and controllers, and a baffled tank. Caustic soda was used to control pH. It was found that excessive chlorination was required most of the time to accommodate occasional peak waste concentrations. Analysis of the problem resulted in relocation of the facilities, development of a modified flow-through batch process, and installation of a caustic soda and chlorine automatic feed control

system. The new plant consists of a primary tank in which chlorine oxidizes cyanides to cyanates and a secondary tank for holding and finishing. Oxidation of cyanates to carbon dioxide and nitrogen starts in the primary tank and is completed in the secondary. Chlorine and caustic soda are added in the process of recirculating the waste in the primary tank, from bottom to top. The firm took a leaf from its own book by using recording pneumatic controllers made by the Brown Instruments Div. for regulating the feed of caustic soda and chlorine. Each automatically resets for load change. The chlorine feed regulation is handled on the basis of continuous measurement of oxidation-reduction potential.

"Automatic Controls Improve Cyanide Wastes Treatment." By

David E. Southwick and James F. Ryan. *Wastes Engineering*, September, 1959.

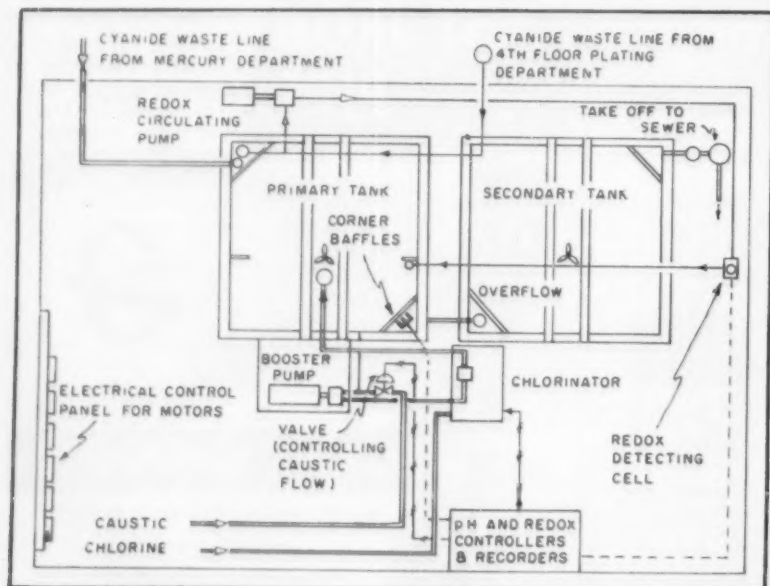
Evaluation of Filter Cloth Media for Wastes

At Cranston, R. I., good operating results were obtained from a new sewage treatment plant until a textile print works and a brewery started discharging wastes to the sanitary sewer. Among the difficulties resulting were a drop in vacuum filter cake discharge to less than 3 psf per hour and an increase in ferric chloride requirements above 6 percent. The wastes were diverted from the plant until pollution conditions demanded that the wastes be treated. Experiments were conducted to improve the plants compatibility for the wastes. These included employment of various types of media for the vacuum filters. It was found possible to increase cake production to 4.23 psf per hour and reduce ferric chloride requirements to 3.78 percent. Improved filter operation was obtained first by use of a string discharge filter and dacron napped cloth media and secondly, by a stainless steel woven Eimco Roto-belt.

"Municipal Plant Receiving Industrial Wastes Experiences Difficulties in Dewatering Sludge." By Walter C. Anderson, *Water and Sewage Works*, September, 1959.

Industry Treats Municipal Wastes

During the past ten years, American Cyanamid Co. has had to choose between three basic alternate solutions to the problem of waste disposal from its Bound Brook, N. J., plant. These were joining either the Middlesex County Sewerage Authority or the Somerset Raritan Sewerage Authority or constructing and operating its own treatment



Courtesy Wastes Engineering

● COMPLETE destruction of cyanides without a wasteful excess of chlorine and caustic soda is controlled by the use of pH and Redox controllers and recorders.

from "Chicago"

INTRODUCING

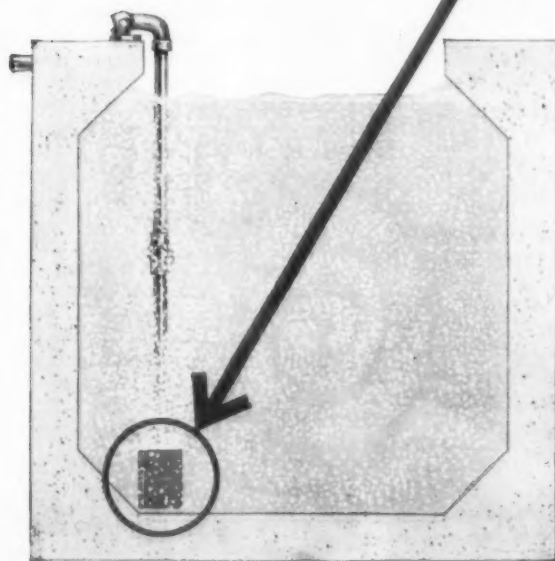
the Hydroshear

AIR DIFFUSION SYSTEM

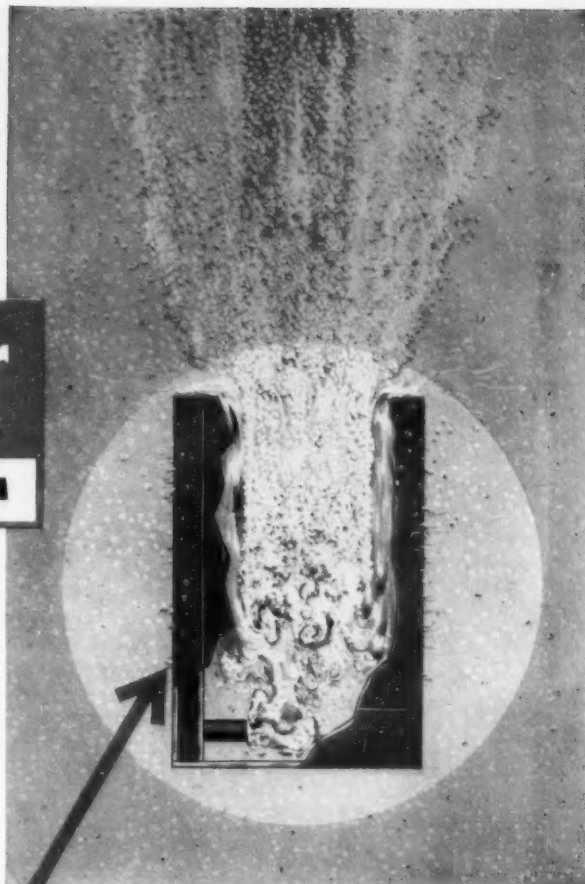
Patents Pending

. . . induced counterflowing air-liquid streams shear large air globules from nozzles into fine bubbles . . . causing instantaneous oxygen transfer to liquid, from turbulence, and thousand-fold increased air film surfaces.

Fine bubbles from porous diffusers are re-circulated by counterflowing streams to greatly increase total oxygen transfer due to sub-surface tank turbulence.



Aeration Tank section showing SWING DIFFUSER with "SHEARFUSER" Header



HYDROSHEAR action in "SHEARFUSER" Nozzle Aerator

PROVIDES

. . . CLOG-PROOF, highest oxygenation and circulation at lowest air pumpage and power usage.

USES

. . . fine bubble "SHEARFUSER" Air Nozzles, or Porous Diffusers, to obtain required aeration . . . combined with SWING DIFFUSERS for operating flexibility.



Putting Ideas to Work

**Chicago
Pump
Company**

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

© 1959—CPCo.—FMC.

Crispin

AIR VALVES

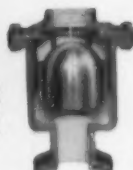
... keep pipelines open

for safe, economical operation

Simplified construction, easy accessibility, maximum durability and efficient cost-saving operation are basic in every Crispin Air Valve.



Crispin
UNIVERSAL AIR VALVES
... positive, full-time air
control when line is filled,
in operation or emptied.



Crispin
AIR & VACUUM VALVES
... permit air to escape
as line fills, allow air to
enter as line empties.



Crispin
PRESSURE AIR
VALVES ... pro-
vide automatic
air escape while line
is under pressure;
prevent air accumu-
lation in line.

FOR AIR CONTROL VALVES
OVER 45 YEARS

multiplex
MANUFACTURING COMPANY
BERWICK, PENNSYLVANIA

Dept. C

Write, wire or phone
for complete information
on dependable Crispin Air
Valves that keep your pipelines
open for safe, economical operation.



"BEST COMPACTORS I'VE EVER USED---"

"Nothing compares—", Easiest handling compactors I've seen—" These and other comments, overheard at the A.P.W.A. Convention at Seattle, Washington, in September, indicate that Wacker Compactors make a big hit with prospects.

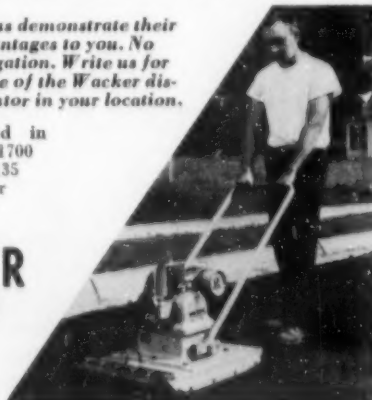
GVR 100-C Wacker Rammer on trench backfilling. Light weight—only 115 lbs. 450 to 650 blows per minute. No skill required.

VPG 1500 Wacker Vibro-Plate used in patching city streets. Five thousand, 1700 lb. impacts per minute. Weighs only 135 lbs. Fifty pounds lighter than other vibrators. Built-in water supply system for asphalt patching.

Let us demonstrate their advantages to you. No obligation. Write us for name of the Wacker distributor in your location.



WACKER
CORPORATION
Dept. PW
HARTFORD 2,
WISCONSIN



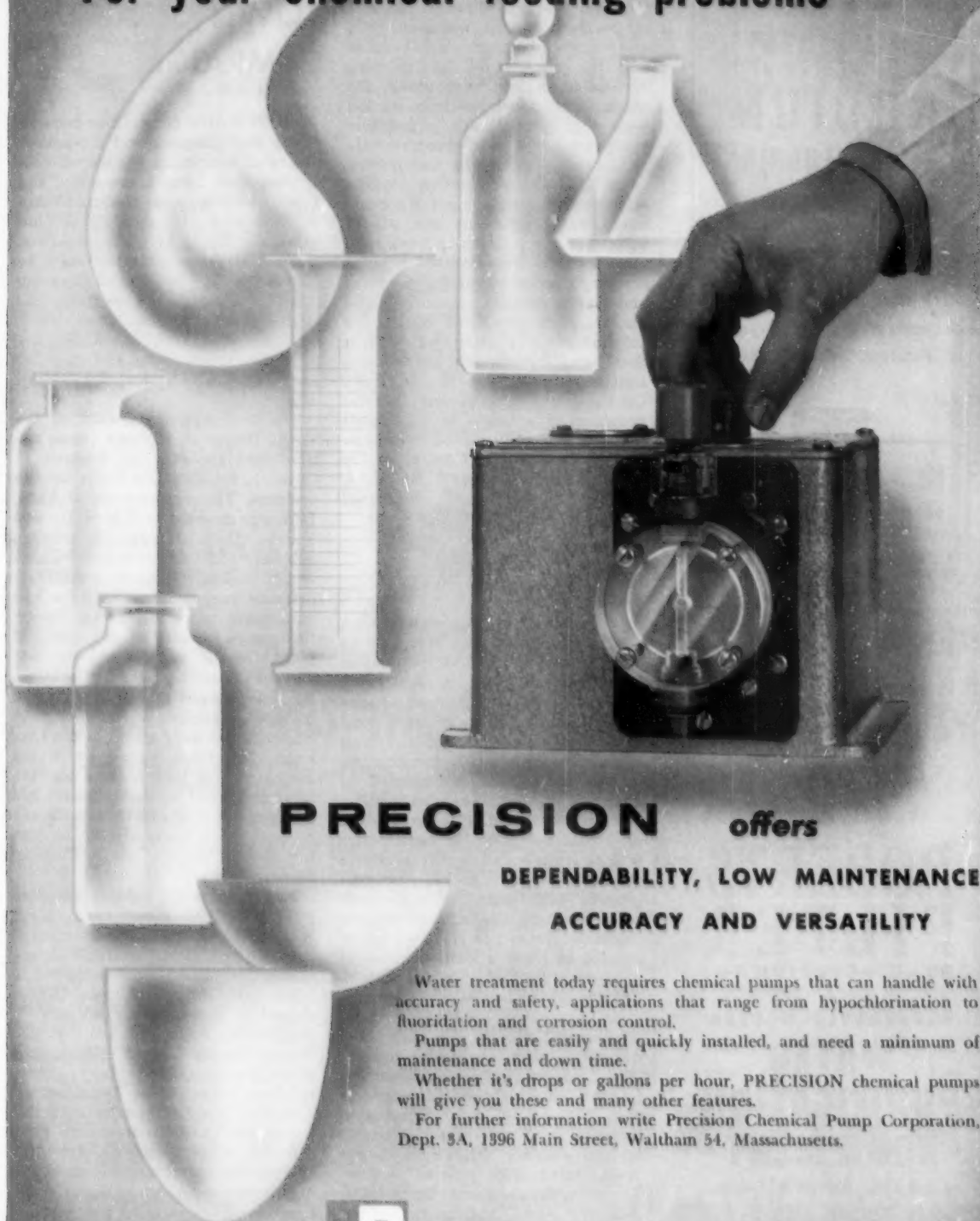
plant. Eventually these were narrowed to the last two. Upon investigation, it was found that the Company's waste treatment problem would constitute 90 percent of the BOD load and a comparable proportion of the total volume of wastes from the authority should it elect to join. The Company decided to construct its own plant for several reasons, including: 1) The pilot plant work showed that biological treatment units for the company wastes would require unusual design and disproportionate volumes for the quantity of waste handled; 2) with its own plant, the Company would be more flexible in increasing capacity or changing the treatment method as plant manufacturing processes change than if it had to depend on public financing; and 3) advance confidential information of the changing nature of the wastes would be available only to industry personnel who could modify operational procedures accordingly. An agreement was worked out with the Authority whereby the Company would provide secondary treatment of the municipal waste from the Authority's primary treatment plant. Since the activated sludge process was employed for the industrial waste treatment, it was felt that additional primary domestic waste effluent would not present serious problems of operation. The agreement was for 20 years with provision for extension. Limitations were placed on injurious or deleterious substances in the primary plant effluent of the Authority plant and on temperature, pH, BOD and suspended solids, but effluents with high BOD and suspended solids may be accepted through payment of a surcharge by the Authority. The Authority agreed to pay for power, chlorine, and laboratory costs for sampling and analysis, amounting to a total of \$7.14 per mg. The Authority was not required to pay any of the amortization costs of the industrial waste plant.

"Industrial and Municipal Cooperation for Joint Treatment of Wastes, I. Industry Approach and Position." By Sheppard T. Powell and James C. Lamb, III. "II, Municipality Approach and Position." By Roy H. Ritter. *Sewage and Industrial Wastes*, September, 1959.

Organized Planning, Research and Training

The Ford Motor Co. has in operation nineteen waste treatment plants and one underground disposal well for handling oil, plating waste, pick-

For your chemical feeding problems



PRECISION *offers*

DEPENDABILITY, LOW MAINTENANCE

ACCURACY AND VERSATILITY

Water treatment today requires chemical pumps that can handle with accuracy and safety, applications that range from hypochlorination to fluoridation and corrosion control.

Pumps that are easily and quickly installed, and need a minimum of maintenance and down time.

Whether it's drops or gallons per hour, PRECISION chemical pumps will give you these and many other features.

For further information write Precision Chemical Pump Corporation, Dept. 3A, 1396 Main Street, Waltham 54, Massachusetts.

PRECISION



CHEMICAL PUMP CORPORATION

1396 Main Street, Waltham, Massachusetts

SODIUM SILICOFLUORIDE
(FLUOSILICATE)

We would like the opportunity to bid on your future requirements—
Please mail invitations to bid to

T.C.
TENNESSEE CORPORATION
1028 Connecticut Ave., N.W.
Washington 6, D.C.

**DOING ONE THING
AND ONE THING
WELL—**

**FOR OVER
60 YEARS!**

**ROBERTS
FILTER
MANUFACTURING CO.**

DEPENDABLE MODERN

**WATER
PURIFICATION
EQUIPMENT**

CALL OR WRITE

**MECHANICAL EQUIPMENT
BY
ROBERTS FILTER MFG. CO.
DARBY, PENNA.**

ling liquor, and assembly plant wastes. The plants are generally designed either by Ford engineers or by retained consulting firms. A sanitary engineering laboratory is maintained for all types of analytical work, industrial waste surveys, and for research on treatment methods. In selection of a treatment method for a particular waste, the waste is classified not only on the basis of origin, as batch or continuous discard, and as to economic value for reclamation. In anticipating quantities, the production layouts and processing equipment are evaluated and limitations are placed within which production personnel may operate. Standardized designs are employed usually for oily wastes and plating wastes. Supervisors and operators of treatment plants are selected early in order to give them first hand information on the design and construction of the plants. On-the-job training of operators and provision of a manual are additional measures to assure good operation.

"Industrial Waste Control in the Ford Motor Company." By F. J. Kallin, *Sewage and Industrial Wastes*, September, 1959.

Detecting Insecticides

Chlorinated organic insecticides, which find their way into surface waters, can damage fish population by tainting the flesh, by destroying the food supply, or by direct poisoning. Although the quantities found in surface waters so far are well below the toxic levels for humans, a disagreeable taste is imparted by 20 p.p.b. of benzene hexachloride. For use in evaluating water quality, analytical methods for sensitivities of 1 or 2 p.p.b. and a general monitoring procedure should be employed. While quantitative methods have been published for benzene hexachloride and DDT it would be helpful to have a single analytical procedure applicable to a substantial number of insecticides. Accordingly, a method was developed by combining carbon filter sampling, adsorption chromatography and infrared spectrophotometry. This was found qualitatively sensitive for less than 10 p.p.b. of eight chlorinated insecticides. A quantitative estimate is also possible. The method has been tested with aldrin, benzene hexachloride, chlordane, DDD, DDT, dieldrin, endrin, and methoxychlor.

"Chlorinated Insecticides in Surface Waters." By A. A. Rosen and F. M. Middleton. *Analytical Chemistry*, October, 1959.

LITTER BASKETS STRESSED IN TOWN CLEAN-UP CAMPAIGN

AS IN MANY cities, litter became a civic disgrace and a constant source of complaints for the officials of America's largest township, the Town of Hempstead, Nassau County, New York. It's over 700,000 inhabitants, living in quiet suburban residential communities adjacent to New York City had moved from the metropolis to get away from just what was slowly creeping into their communities—litter, untidiness, indiscriminate dumping and all that goes with unsightly and unhealthful conditions.

The Presiding Supervisor of the Town, Harold P. Herman (since retired and replaced by Edward P. Larkin), set about to clean up the problem. The entire month of April, 1956, was devoted to "Clean-Up and Spruce Up." Household articles, rubbish and other debris which would ordinarily have wound up littering vacant lots, roadsides and waterways were picked up during the entire month at no cost. If placed at the curb, the litter was carried away by Town Highway, Park Department, sanitary district or district contractors' trucks. The response was very good. In the four succeeding years during which the campaign has been conducted, the tonnage picked up and dumped has increased 23-fold. In 1959, 2,528 additional truck loads of rubbish was handled during the April "Cleanup Month."

Having seen the public's response to help keep the Town clean, plans were made to organize a permanent Anti-Litter Committee. Town Councilman Ralph G. Caso was named to head the 1959 committee. Others named to assist were Frederick W. Trautwein, Superintendent of the Town's newly-formed Department of Sanitation, and other key personnel from various Town Departments.

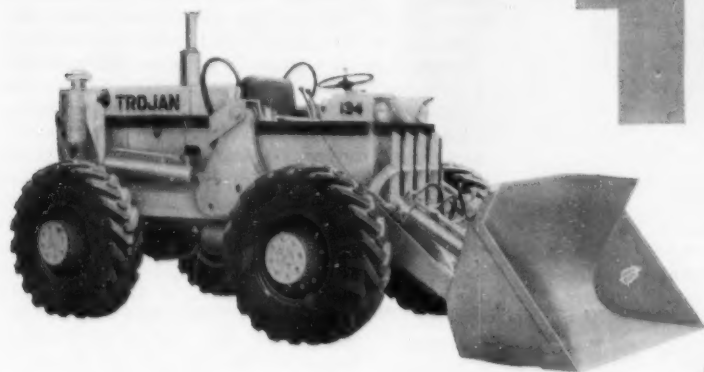
One of the first projects of this committee has been to secure 1,000 Wheeling Corrugating No. 420 litter receptacles for placement throughout the Town on streets and at shopping areas. A stepped up program of street sweeping has been planned.

As a tool with which to promote tidiness and cleanliness, an Anti-Litter Ordinance has been adopted

NEWEST IN THE EXPANDING LINE

134

164



MODEL 134
8,000 LB. CAPACITY

MODEL 164
10,000 LB. CAPACITY



TROJAN makes what it takes for any job!

Now you can bid any size job—secure in the knowledge that this complete Trojan line fits any and all applications. With the introduction of the 134 and 164, both one-machine owners and fleet operators alike may choose from a full working range . . . 1 to 4 cubic yards in lifting capacities from 5,000 to 24,000 lbs. . . making available to every operator a model precisely matched to his needs . . . Add up the many Trojan benefits and features, you will then see why any one of these models could mean extra profits from the very first working day . . . Put yourself ahead—ask your distributor to demonstrate the Trojan model of your choice.

TROJAN 134

This $1\frac{1}{2}$ yard machine, with an 8,000 lb. lifting capacity, has an 8'8" dump height, 2'5" forward reach and gas or diesel power.

TROJAN 164

Here is a $1\frac{3}{4}$ yard loader with a 10,000 lb. lifting capacity, 8'6" dump height, 2'9" forward reach and choice of gas or diesel power.

The Trojan line includes models with lifting capacities from 5,000 to 24,000 lbs. and bucket capacities from 1 to 4 cu. yds.

THE YALE & TOWNE MANUFACTURING COMPANY
TROJAN DIVISION

BATAVIA, NEW YORK • SAN LEANDRO, CALIFORNIA

TROJAN®
TRACTOR SHOVELS

YALE & TOWNE



● 1,000 new litter receptacles are being placed on streets and in shopping areas as part of the anti-litter campaign conducted by the Town of Hempstead, New York.

Pneumatic Handling of Dry Chemicals at a Small Water Treatment Plant

AIR CONVEYING is sometimes considered suitable only for large plants with large bulk handling requirements, but the flexibility and automatic handling features of air conveying can be applied with surprising effectiveness to meet small handling needs.

A leading example is the Dracco Airstream Conveyor installed at the water treatment plant in Archbold, Ohio. This facility serves a population of only 1,486 people and uses but one truckload of bulk lime every six to eight weeks. Nevertheless, the pneumatic system provides worthwhile economies by eliminating manual handling and permitting bulk purchasing of lime.

The complete, self-contained conveying system moves lime at 8 to 10 tons per hour, performs three separate handling functions and includes a 30-ton capacity storage bin. Total cost for the bulk handling and storage system was less than \$25,000.

Installed as original equipment in an addition to the Archbold plant, the suction-pressure type conveyor is fully integrated with old and new structures for maximum performance versatility. It moves lime 1) from truck to storage; 2) from storage to day bin; and 3) from truck to day bin.

One man can perform these operations. A flexible metal hose,

equipped with a portable intake nozzle, is used to unload the truck. Material moves to the receiving station by suction, through an air-locked discharge mechanism and into a flexible pressure line leading to the storage bin inlet pipe.

To reclaim lime from storage and move it to the day bin, the operator merely switches the flexible pressure line to another pipeline. Material is drawn back to the receiving

by the Town Board. It covers all aspects of littering. Next year, it is hoped that the Department of Sanitation will be augmented by the addition of more sanitary inspectors.

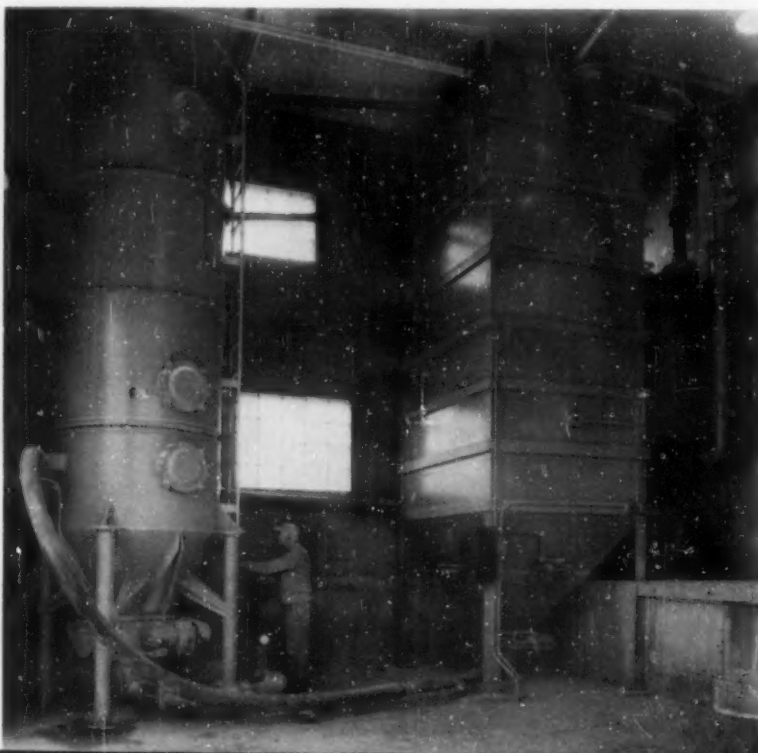
Presently, routine inspections are being made of all business areas within the Town. Personal complaints are handled on a prompt basis. Even the residential home that becomes littered does not escape. These people (fortunately there are few), are made to realize what they can eventually do to a neighborhood.

The Town has carried out an intensive educational program. Adopting the slogan, "Let's All Become Litter Conscious," newspapers, banks, railroads and other enterprises are cooperating through advertising, radio time and other media to help promote the highly successful program.

station and then blown to the day bin in another part of the plant.

All bin loading operations are vented by a bag-type dust collector. Collected material is returned to the conveyor system. This avoids waste, in-plant dust and external air pollution.

This semi-automatic system completely eliminates manual handling of lime. Bulk buying of lime saves some 16 percent on material costs compared to buying in bags. These savings illustrate why pneumatic handling of dry chemicals is an important practical consideration for water treatment plants of any size.



● AIR conveyor installation for chemical handling at Archbold water works.

Public Works Responsibilities in EMERGENCIES

IT SEEMS TO ME that each and every day's operation of a Public Works department is either an emergency or perhaps a routine to avoid an emergency. We have learned that actions or omissions which disrupt the normal pattern of life of even a small segment of our population can, to those concerned, be an emergency.

The favorable position which Kansas City enjoys started with a small settlement on the Missouri River. That river has furnished the water necessary for the development of our central city and of the metropolitan area of which we are a part. That river will continue to play a major role in the future expansion of our area as our position on the Inland Waterway System becomes a reality.

That same river, which has for more than one hundred years been a blessing, has often threatened to harm or destroy us. As you know, we are located at the confluence of

REED MCKINLEY
Director of Public Works,
Kansas City, Missouri

the Missouri and Kansas rivers. We feel certain that we will never again be subject to a disaster-type flood from water of the Missouri River because of the system of multipurpose retention reservoirs on the upper stem of the Missouri River. These reservoirs, such as Fort Peck, Randall, Gavion's Point and Oahe, retain the surplus water from spring thaws and rains and permit the release for beneficial use as needed.

The possibility of devastation from the Kansas River presents an entirely different picture. Until recently, Kansas was reluctant to support a water control program. It was not flooding but water shortage during the drought years that caused a reversal of this thinking. The start on the Kansas River basin control has been made by the construction of the Tuttle Creek reservoir. Prog-

ress, although slow, is being made by the Army Engineers in planning for other reservoirs to complete the system, eventually to the same degree of control as that which now exists on the Missouri. Until that time arrives, our city is as vulnerable to the ravages of a super flood from the Kansas River as we were in 1951.

During the periods of high river stages, even when there seems to be little or no danger of overtopping the flood protection devices, a section of the Public Works Department is busy. At certain known river stages, the outlets of the gravity sewers cease to function and backwater from the river into the large trunk sewers could cause flooding of basements in the low-lying industrial areas. Therefore, at each of the sewer outlets we have sewer pumping stations equipped with floodgates and pump capacity to discharge by pressure all sewage and stormwater which accumulates landward of the

Water Supply and Purification

by Col. W. A. Hardenbergh

WATER SUPPLY and PURIFICATION



**A Useful Book
For Your
Engineering Library**

**Only \$7.25
Write to:**

**Book Department
Public Works Magazine
200 South Broad Street
Ridgewood, New Jersey**

AN authoritative yet simple treatment of the subject by one of the nation's foremost authorities, whose editorial and field work have brought him in close contact with the problems that trouble the average engineer. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods.

Among the major changes introduced in this latest edition are the following: the chapters on ground water, on filtration, and on laying pipe and maintenance lines have been almost completely rewritten; the chapters on pipe conduits and on disinfection have been revised to bring the material in them up to date and a new chapter has been added on fluoridation.

Order your copy today

Limited number of copies available in Portuguese.

Only the Trojan Pipe Puller & Pusher

gives you continuous action

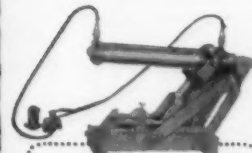
No Resetting of Grip!



Model A for
1/2" to 1" pipe



Model B for
3/4" to 2" pipe



**NEW AIR POWERED
Model B**

Does all the work for you.
Handles 3/4" to 2" pipe.

**CUTS COSTS!
SAVES TIME-**
in installing or renew-
ing pipe under pavement

The Trojan combines pushing and pulling operations in one machine—eliminates all time-killing resetting of grip—keeps pipe continuously moving. Does the job at lower cost—in far less time.

Model A weighs 65 lbs.—requires only 5" trench. One man can easily install the average service. 15 tons of pushing pressure possible.

Model B (either hand or air powered) needs only 5 1/2" trench—has 3 speeds for different soils—is reversible in 30 seconds. Push pipe comes in 30" lengths, assures straight travel.

Write today for full details!

The TROJAN Manufacturing Co.

1114 Race Drive • Troy, Ohio

CLASSIFIED ADVERTISING AND JOB OPPORTUNITIES

POSITION AVAILABLE

Written applications are now being accepted for the position of Superintendent of a Sewage Treatment and Refuse Disposal Plant designed to serve 40,000 people in Bradford, Pennsylvania, area. This plant, now under construction, is scheduled for commencement of operation in the summer of 1960. Services of the Superintendent are desired in advance of operation to assist with supervision of equipment installation. Plant facilities include refuse incinerators, sludge incinerator, vacuum filter, chemical precipitation equipment, etc. Salary will be commensurate with ability.

Application shall be made only in writing, in duplicate, and should state experience, education, age, present salary and any recommendations, and should be addressed to:

Mr. R. J. Brennan, Chairman
Bradford Sanitary Authority
101 Main Street
Bradford, Pennsylvania

All replies will be strictly confidential.

DPW—Superintendent Wanted

Applicants must be experienced in road maintenance, road construction and drainage work and must have administrative experience. Degree in civil engineering is desirable. Starting salary, \$6,000 a year with a \$500 increase after six months and with automatic increases each year thereafter until the maximum of \$9835 is reached in 5 years. Liberal vacation, sick leave, holidays and other benefits. All applications will be held in the strictest confidence.

Address all applications to:
Dr. Arnold Barton, Chairman
Board of Selectmen
Town Hall
Sharon, Massachusetts

TECHNICAL SALES MANAGER

Basic Chemical Specialty Manufacturer selling odor and waste control products to industry, municipalities and institutions desires man to head Technical Sales Department. Sanitary Engineering/Sales background helpful but not essential. Excellent opportunity.

Reply to:
Box 11-1
Care of Public Works Magazine

Administrative Assistant

Salary \$4884 to \$5808 per year. Graduates work desired. Apply to:

Mr. Robert W. Duncan
Village Manager
Shorewood, Wisconsin

PUMP APPLICATION PROPOSAL ENGINEER

Our Pump Division has an opening at our Aurora, Illinois plant for an experienced pump man interested in a steady position with a leader in the field of pumps, sewage treatment, water and waste treatment, mixing etc.

Reply by mail and in full detail giving background, business and personal, including salary requirement.

Office of the President
The American Well Works
Aurora, Illinois

WATER SUPERINTENDENT

The Village of La Grange, Illinois is seeking applications for the position of Water Superintendent. Will have charge of complete water works system, including treatment and distribution. 3 MGD plant. Lime-soda ash-zeolite softening process. Salary \$7,200—\$8,520. Attractive fringe benefits. Apply submitting resume of education and experience to:

Robert E. Meyer
Village Manager
La Grange, Illinois

IF YOU WANT TO:

- Sell Used Equipment
- Hire Personnel
- Obtain Employment
- Make Announcements

Use Our Classified Section
For Quick Results

Write to:
Classified Ad Dept.
Care of this Magazine

VALUABLE INFORMATION FOR ENGINEERS

Thousands of progressive engineers are finding that our readers' service section is the easy, handy way to obtain new catalogs of advertised products. Be sure and return the postage free reply card opposite page 34.

SEE PAGES 32 to 45

levees and flood walls. We have established a warning system whereby all persons concerned are notified of river stages which may demand operation of the lift stations. At the lower stages, only the Commissioner responsible for activating the stations is alerted. As the river rises to higher levels, other agencies of government are notified. By this progressive warning, we are assured that well before the river reaches a stage of threatened overtopping the flood walls and levees, the entire Public Works Department is standing by with specific assignments made to each section, down to work crews within the smaller units.

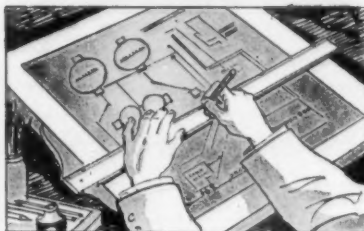
This warning program has been thoroughly covered by an Administrative Regulation from the City Manager in order that other segments of the city government besides the Public Works Department may be alerted stage by stage and determine their probable need for action. This plan for warning or alert is in operation around the clock, seven days a week, whenever river stages necessitate closing of the backwater gates at the sewer lift stations. It is an assurance that a general alert will be in effect if and when the situation reaches disaster proportions.

Such was the case in July, 1951, when water from the Kansas River overtopped and broke through the levee system on the Kansas side of the State Line and brought with it destruction of an extent that has never been fully documented. It has been called the Billion Dollar Flood. It has been represented to the Congress of this country that the loss to the Federal Government in 1951 federal income tax by the damage so created would, for that one year, more than pay for the complete construction of the retention reservoirs needed to prevent a recurrence. However, Congress delayed for several years before making an appropriation for the start of the first unit of the program so greatly needed for the Kansas River valley.

This 1951 flood is, in the cycle of frequency, known as a "100-Year Flood." The previous one was in 1844, which gives a 107-year frequency. The next "100-Year Flood" may come any time in that period, be it 2051 or 1960. There is, therefore, real cause to maintain our warning, alert and planned program of operation.

A most unusual situation existed in that spring of 1951. Over practically all of the Kansas River watershed, there had been some forty days of heavy rains. The

CONSULTING ENGINEERS

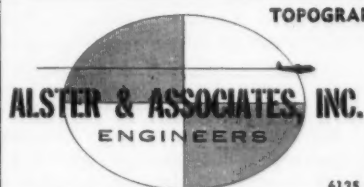


CITY, COUNTY

AND STATE

Mr. Consulting Engineer . . .

Increase your sales power to the growing public works field by including your professional card in our **DIRECTORY OF CONSULTING ENGINEERS**. For rates in this section write to:
Public Works Magazine
200 So. Broad St.
Ridgewood, New Jersey



TOPOGRAPHIC • PLANIMETRIC • MOSAIC MAPS

ALSTER & ASSOCIATES, INC. cuts your mapping costs

ENGINEERS

Write for free brochure on mapping and aerial photography.

6135 Kansas Ave., N.E., Washington 11, D.C. TA 9-1167

Brockway, Weber & Brockway

Engineers, Incorporated

George S. Brockway

Roy E. Weber

George R. Brockway

H. L. Fitzgerald

Ben E. Whittington

Robert E. Owen

Ernest L. Greene

Thomas A. Clark

Thomas R. Demery

Charles A. Anderson

Civil, Structural, Sanitary, Municipal, Electrical, Land Planning

West Palm Beach, Florida

Ft. Pierce, Florida

GIBBS AND HILL, INC.

Consulting Engineers

Industrial Wastes
Water & Sewage Works
Hydraulic Developments

Electric Transmission & Distribution Systems
Conventional & Nuclear Power Generation
Power Surveys & Contracts

Airports
Rapid Transit
Highways & Bridges

Los Angeles 14, Calif.
510 W. 6th St.

NEW YORK 1, N.Y.
Pennsylvania Station

Tampa, Fla.
608 Tampa St.

PALMER AND BAKER ENGINEERS, INC.

CONSULTING ENGINEERS — ARCHITECTS

Surveys-Reports-Design-Supervision-Consultation
Transportation and Traffic Problems
Tunnels-Bridges-Highways-Airports-Industrial Buildings
Waterfront and Harbor Structures, Graving and Floating Dry Docks
Complete Soils, Materials and Chemical Laboratories

Mobile, Ala.

New Orleans, La.

Washington, D.C.

ROBERT AND COMPANY ASSOCIATES

Municipal Engineering Division

ATLANTA

WATER SUPPLY, SEWAGE DISPOSAL, INCINERATORS, POWER PLANTS



Abrams Aerial Survey Corporation

Photogrammetric Services

AERIAL PHOTOGRAPHY,
TOPOGRAPHIC MAPS,
ATLAS SHEETS AND MOSAICS

IVenhoe 4-9441

Lansing, Michigan

AERO SERVICE CORPORATION

Aerial topographic maps—photo-maps for engineering projects anywhere in the world—highways, railroads, cities, power and pipe lines, mining development. Soil studies and electronic surveys of large areas; resources inventories.

210 E. Courtland

Philadelphia 20

AIRWAYS ENGINEERING CORP.

Airports, Highways, Dams, Fuel Storage,
Pipe Lines, Harbor Developments

1212-18th St., N.W. Washington 6, D.C.

Phone: REpublic 7-8131

ALBRIGHT & FRIEL INC.

Consulting Engineers

Water, Sewage, Industrial Wastes and Incineration Problems
City Planning Highways, Bridges and Airports
Dams, Flood Control, Industrial Buildings
Investigations, Reports, Appraisals and Rates

THREE PENN CENTER PLAZA
PHILADELPHIA 2, PENNSYLVANIA

ALVORD, BURDICK & HOWSON

Engineers

Water Works, Water Purification,
Flood Relief, Sewage, Sewage Disposal, Drainage, Appraisals, Power Generation

20 No. Wacker Dr.

Chicago 6, Ill.

AMERICAN AIR SURVEYS INC.



Aerial Topographic Maps
Aerial Photos & Mosaics

for

• municipal planning & engineering

• pipe lines • roads, airports • tax maps

907 Penn Ave., Pittsburgh 22, Pa.

A Nationwide Service

MICHAEL BAKER, JR., INC.

THE Baker Engineers

Civil Engineers, Planners, and Surveyors
Airports, Highways, Sewage Disposal Systems,
Water Works Design and Operation—
City Planning—Municipal Engineering—
All types of Surveys

Home Office: Rochester, Pa.

Jackson, Miss. Branch Office: Harrisburg, Pa.

BARNARD AND BURK

Consulting Engineers

Municipal and Industrial Engineering Surveys,
Reports, Waterworks, Sewerage and Sewage Disposal, Revenue Projects, Natural Gas, Light and Power, Streets and Highways, Harbor and Port Developments

1023 Nicholson Drive
Baton Rouge, Louisiana

CARL BUSSOW

Consulting Chemist and

Paving Engineer

Specialist on
Asphalt Petroleum and
Tar Products

301 Second Ave.

New York 17, N.Y.

BANISTER ENGINEERING CO.
Consulting Engineers

"Staffed to completely fill municipal requirements for professional service"
310 No. Snelling Ave. Tel. Midway 6-2612
St. Paul 4, Minnesota

FOR RATES FOR THIS SPACE

write

PUBLIC WORKS MAGAZINE

200 So. Broad St. Ridgewood, N.J.

E. D. BARSTOW & ASSOCIATES

Engineers

Water Supply, Treatment, Distribution
Sewage Collection, Treatment, Disposal
Trade Waste Treatment
163 N. Union St. Akron 4, Ohio

FOR RATES FOR THIS SPACE

Write

PUBLIC WORKS MAGAZINE

200 So. Broad St., Ridgewood, N.J.

**LAWRENCE T. BECK
AND ASSOCIATES**

Engineers and Consultants

Philadelphia New York Washington

HOWARD K. BELL

Consulting Engineers

G. S. Bell C. G. Gaither J. K. Latham
J. W. Flinn, Jr.

Water Works Sewage Disposal
Water Purification Sewerage
Swimming Pools Refuse Disposal
Industrial Wastes

553 S. Limestone St. Lexington, Ky.

BLACK & VEATCH

Consulting Engineers

Water—Sewage—Electricity—Industry
Reports, Design, Supervision of Construction
Investigations, Valuations and Rates
1500 Meadow Lake Pkwy., Kansas City 14, Mo.

CLINTON BOGERT ENGINEERS

Consultants

Clinton L. Bogert Ivan L. Bogert
Donald M. Dittmars Robert A. Lincoln
Charles A. Mangano William Martin

Water & Sewage Works Incinerators
Drainage Flood Control
Highways and Bridges Airfields

145 East 32nd Street, New York 16, N. Y.

BOWE, ALBERTSON & ASSOCIATES

Engineers

Sewage and Water Works
Industrial Wastes — Refuse
Disposal — Municipal Projects
Industrial Buildings — Reports
Plans — Specifications
Supervision of Construction
and Operation — Valuations
Laboratory Service
73 West Street, New York 6, N.Y.

BOYLE ENGINEERING

Architectural & Engineering Consultants

Water—Development, Treatment, Storage, Dis-
tribution, Sewage Collection, Sewage Treat-
ment, Refuse
Waste Disposal—Industrial, Commercial, Residen-
tial, Municipal, Highways, Streets, Bridges,
Parks, Harbors, Flood Control, Special Dis-
tricts, Civic, Industrial, Commercial Buildings,
Structures, Site Planning
Bakersfield Santa Ana San Diego
California

BROWN ENGINEERING CO.

Consulting Engineers

Waterworks, Sewage Disposal, Airports
Street Improvements, Power Plants
Electric Distribution, Rates
308 TENTH STREET DES MOINES 9, IOWA

BROWN AND CALDWELL

Civil and Chemical Engineers

Water — Sewage — Industrial Waste
Consultation — Design — Operation
Chemical and Bacteriological Laboratories
66 Mint Street San Francisco 3

Floyd G. Browne and Associates

Consulting Engineers

F. G. Browne S. W. Kuhn
W. G. Smiley G. M. Hinkamp
C. W. Martin W. H. Kuhn
Water Supply and Purification — Sewage and
Industrial Waste Treatment — Refuse Dis-
posal — Electric Systems — Surveys — Reports
Valuation and Rates
Marion, Ohio

BUCK, SEIFERT AND JOST

Consulting Engineers

Water Supply Sewage Disposal
Hydraulic Developments
Reports, Investigations, Valuations
Rates, Design, Consultation, Operation
Management, Chemical and
Biological Laboratories
112 East 19th St. New York City

BURGESS & NIPLE

Consulting Engineers

Established 1908

Water supply, treatment and distribution
Sewage and industrial wastes disposal
Investigations, reports, appraisals, rates
Airport, Municipal Engineering, Supervision
2015 West Fifth Ave. Columbus 12, Ohio

RALPH H. BURKE, INC.

Consulting Engineers

Traffic Studies Underground Garages
Parking Structures Grade Separations
Expressways, Airports and Terminal Buildings
Shore Protection Municipal Engineering
Parks Field Houses Swimming Pools
20 North Wacker Drive, Chicago 6, Ill.

BURNS & McDONNELL

Engineers - Architects - Consultants

4600 E. 63rd ST., TRAFFICWAY
KANSAS CITY 41, MISSOURI

FOR RATES FOR THIS SPACE

WRITE

PUBLIC WORKS MAGAZINE

200 So. Broad St., Ridgewood, N.J.

ground had become so saturated that by July all rains caused a 100 percent runoff. The rivers were rising, causing us to put into operation all of our lift stations. We were further alerted by a situation which developed on the Blue River, normally an almost dry-run creek that traverses the industrial district on the east side of our city. We rode out the cresting, which threatened industries in that area on the night of July 11-12, with no serious damage. I had spent the day of July 11th and the night which followed maintaining contact with the gauging stations and the industries. We were watching and plotting the movement of this water as the crest rapidly advanced through the valley.

In the meanwhile, the Kansas River continued to rise. Trouble developed in two of the older stations where back pressure devices had never, in 30 years of existence, been subjected to the extreme pressure then being encountered. Field operations were being controlled around the clock with responsibility being divided between the City Engineer and myself on a 12-hour shift basis. All of our labor force was either on a stand-by basis or on regular work assignments with arrangements for rapid mobilization in case of need.

We felt confident that we would be able to resist the back pressure in the two old stations and thereby prevent flooding the landward side. We were a bit relieved at the morning announcement that our Industrial District did not need to fear flooding by overtopping the levees. However, it was not then known that rain of cloudburst intensity was falling on the two minor watersheds nearest to our city. A call from the Army Engineers advised the City Manager that the levees above Kansas City on the Kansas River had been overtopped and there was no chance of repairing the breach. The Manager, through all media of information, advised all those in the Central Industrial District to evacuate the flood plain. The area was not surrendered to the flood without a fight by the Public Works staff. The pumping stations were kept operating as long as possible in the hope that full failure had not occurred in the levees. Some of our staff stayed with the stations until their cars were so flooded that they would not start.

The 20-foot depth of water sweeping down this industrial area, inside our flood walls, created a situation impossible to describe. This Kansas River water finally reached the concrete flood wall of the Mis-

CAMP, DRESSER & McKEE**Consulting Engineers**

Water Works and Water Treatment
Sewerage and Sewage Treatment
Municipal and Industrial Wastes
Investigations and Reports
Design and Supervision
Research and Development
Flood Control

6 Beacon St. Boston 8, Mass.

Capitol Engineering Corporation**Consulting Engineers**

Water Works Sewage Systems
Design and Surveys Roads and Streets
Planning Airports
Bridges Dams

Executive Offices: Dillsburg, Pa.
Dallas, Texas Rochester, N.Y.
Pittsburgh Washington
Saigon, Vietnam

JOHN A. CAROLLO**Consulting Engineers**

Water Supply and Purification. Sewerage
Sewage Treatment. Power Generation and
Distribution. Gas Systems. Valuations

3308 N. Third St., Phoenix, Arizona
2168 Shattuck Ave., Berkeley 4, Calif.

THE CHESTER ENGINEERS

Water Supply and Purification
Sewage and Industrial Waste Treatment
Power Plants—Incineration—Gas Systems
Valuations—Rates—Management
Laboratory—City Planning

681 Suismen Street, Pittsburgh 12, Penna.

CHICAGO AERIAL SURVEY

PHOTOGRAMMETRIC ENGINEERS
Aerial photography since 1923. Complete
photogrammetric services for city, county,
highway and consulting engineers.
Developers of Sonne Strip Photography
• Base maps and atlas sheets • Precise topo-
graphic maps for sewerage studies, construction
planning and site location. • Scaled mosaics and
pictorial presentations • Highway studies. Street
and road maps. Sonne photography.
10265 FRANKLIN AVE., FRANKLIN PARK, ILL.
A Division of Chicago Aerial Industries, Inc.

CLARK & GROFF ENGINEERS**Consulting Engineers**

Civil, Sanitary & Municipal Engineering
Investigations, Reports, Plans
Supervision of Construction
Laboratory

3240 Triangle Dr. Salem, Oregon

CHAS. W. COLE & SON**Engineers—Architects**

3690 E. Jefferson Blvd. 2112 W. Jefferson St.
South Bend, Indiana Joliet, Illinois

**CONSOER, TOWNSEND & ASSOC.
—CONSULTING ENGINEERS—**

Sewage treatment, sewers, storm drainage, flood
control—Water supply and treatment—Highway and
bridges—Airports—Urban renewal—Electric and gas
transmission lines—Rate studies, surveys and valua-
tions—Industrial and institutional buildings.

360 EAST GRAND AVENUE
CHICAGO 11, ILLINOIS

CRAWFORD, MURPHY & TILLY**Consulting Engineers**

Water Works—Impounding Reservoirs
Highways—Municipal Streets—Expressways
Traffic Problems—Airports—Swimming Pools
Sewers—Sewage Treatment—Wastes Treatment
Storm Drainage—Flood Control—Surveys & Reports

736 So. Grand Ave., W. Lakeside 8-5619
Springfield, Ill.

ALFRED CREW**Consulting Engineers**

Water Supply, Treatment and Distribution
Sewerage and Sewage Disposal
Drainage and Industrial Wastes

45 N. Broad St. Ridgewood, N.J.

DANIEL, MANN, JOHNSON & MENDENHALL**Planning - Architecture - Engineering**

Airports Water Supply & Purification
Harbors Sewage Treatment Plants
Rapid Transit Storm Drains
Urban Renewal Municipal Buildings
Traffic & Parking Industrial & Commercial
Reports & Consultations Buildings

3325 Wilshire Boulevard Los Angeles, Calif.
Honolulu, Hawaii Washington, D.C.

DE LEUW, CATHY & COMPANY**Consulting Engineers**

Public Transit Subways
Traffic & Parking Railroad Facilities
Expressways Industrial Plants
Grade Separations Municipal Works
Urban Renewal Port Development

150 North Wacker Drive, Chicago 6
San Francisco Toronto Boston

H. G. DILL COMPANY**Consulting Engineers**

H. G. Dill J. A. Rousculp
G. W. Hockaden B. W. Lipas
Civil, Sanitary, Structural, Municipal, Highway,
Subdivision, Planning, Property Surveys, Topo-
graphic Surveys, Reports, Appraisals.

2607½ No. High St. Columbus 2, Ohio
AM 2-9744

ROY B. EVERSON

Water Treatment Service Since 1906 for Swim-
ming Pool Circulating Systems. Purification Sys-
tems as applied to Sewage Treatment and Water
Works. A New System for Automatic Control.

237 W. Huron Street, Chicago 10, Ill.

**FAY, SPOFFORD &
THORNDIKE, INC.****Engineers**

Airports — Bridges — Express Highways
Industrial Bldgs.—Incinerators—Part Developments
Water Supply — Drainage and Sewerage Systems
11 Beacon Street, Boston, Mass.

FINKBEINER, PETTIS & STROUT

Carlton S. Finkbeiner Chas. E. Pettis
Harold K. Strout

Consulting Engineers

Reports — Designs — Supervision
Water Supply, Water Treatment, Sewerage,
Sewage Treatment, Wastes Treatment,
Valuations & Appraisals

2130 Madison Avenue Toledo 4, Ohio

WALTER H. FLOOD & CO.**Chemical Engineers**

Inspection and Testing of Materials and Structures
Streets — Roads — Airports
Building and General Engineering Construction
Resident Inspection — Chemical & Physical Tests
Soil Boring & Investigation—Concrete Core Cutting
Specifications — Reports — Research

6102 S. Blackstone Ave. Chicago 37, Ill.

**FRIDY, GAUKER,
TRUSCOTT & FRIDY, INC.****Engineers**

Hospitals, Schools, Industrial Buildings,
Public Buildings, Airports, Roads, Water,
Sewage, Petroleum Facilities, Waste Dis-
posal, Power & Lighting, Reports, Plans,
Supervision, Appraisals.

1321 Arch Street Philadelphia 7, Penna.

GRAY and OSBORNE**Consulting Engineers**

Specializing In
Municipal Utilities — Design
Feasibility — Valuations — Rate
Studies — Master Planning

228 South 2nd St. Yakima, Washington

FOR RATES FOR THIS SPACE**WRITE****PUBLIC WORKS MAGAZINE**

200 So. Broad St., Ridgewood, N.J.

GILBERT ASSOCIATES, Inc.**Engineers and Consultants**

Power Plant Engineering
Water Supply and Purification
Sewage and Industrial Waste Treatment
Chemical Laboratory Service

New York READING, PA. Washington

FOR RATES FOR THIS SPACE**WRITE****PUBLIC WORKS MAGAZINE**

200 So. Broad St., Ridgewood, N.J.

GREELEY & HANSEN**Engineers**

Water Supply, Water Purification
Sewerage, Sewage Treatment
Flood Control, Drainage, Refuse Disposal
14 East Jackson Blvd., Chicago 4, Illinois

HOWARD R. GREEN CO.**Consulting Engineers**

DESIGN AND SUPERVISION OF
MUNICIPAL DEVELOPMENTS
Water Works and Treatment—Sewers
and Sewage Disposal—Investigations
and Valuations

208-10 Bever Bldg., Cedar Rapids, Iowa
Established 1913

**WILLIAM F. GUYTON AND
ASSOCIATES****Consulting Ground-Water Hydrologists**

Underground Water Supplies
Investigations, Reports, Advice

307 W. 12th St., Austin 1, Texas
Phone: GR 7-7163

HARDESTY & HANOVER**Consulting Engineers**

Long Span and Movable Bridges, Hanover
Skew Bascule, Grade Eliminations, Foundations,
Expressways and Thruways, Other Structures,
Supervision, Appraisals, and Reports

101 Park Avenue, New York 17, N.Y.

HAVENS AND EMERSON

A. A. Burger H. H. Mosley
J. W. Avery F. S. Paloczay
E. S. Ordway G. H. Abplanalp
A. M. Mock S. H. Sutton

Frank C. Tolles, Consultant**Consulting Engineers**

Water, Sewerage, Garbage, Industrial Wastes,
Valuations—Laboratories
Lander Bldg. Woolworth Bldg.
Cleveland 14, O. New York 7, N.Y.

HAZEN AND SAWYER*Engineers*

Water and Sewage Works
Industrial Waste Disposal
Drainage and Flood Control
Reports, Design, Supervision
of Construction and Operation
Appraisals and Rates

121 East 42nd St.
New York 17, N.Y.

3333 Book Tower
Detroit 26, Mich.

HENNINGSON, DURHAM & RICHARDSON, INC.*Consulting Engineers*

Consulting Engineers since 1917 for
more than 700 cities and towns.
Water Works, Light and Power, Sewerage,
Paving, Airports, Reports,
Appraisals, Drainage

2962 Huron St. Omaha 2, Nebr.

HILL & HILL
Engineers

Sewage and Waste Disposal,
Water Supply and Filtration,
Dams, Reservoirs, Tunnels,
Airport and Topographic Surveys

Home Office: 8 Gibson St., North East, Pa.

HAROLD HOSKINS & ASSOCIATES*Consulting Engineers*

Sewers and Sewage Treatment
Paving Water Supply Drainage
Bridges Airports Reports
Aerial Photogrammetry
Power Plants Surveys

1639 Quo St., Lincoln 8, Nebr.
1015 Eight Avenue, Greeley, Colorado

MARK HURD AERIAL SURVEYS, INC.

Topographic And Planimetric Maps
Tax Maps Aerial Photography

230 Oak Grove Street Minneapolis 3, Minn.

Jenkins, Merchant & Nankivill
Consulting Engineers

Municipal Improvements Gas Systems
Highways and Airports Water Systems
Power Development Sewerage Systems
Traffic Surveys Industrial Plants
Flood Control Recreational Facilities
Investigations and Reports

801-805 East Miller St., Springfield, Ill.

JOHNSON DEPP & QUISENBERRY Inc.*Consulting Engineers*

Highways Water Supply
Airports Sewage Disposal
Planning Surveys

915 Frederica St. Owensboro, Ky.

JOHNSON SOILS ENGINEERING LABORATORY

Laboratory and Field Testing
Shrink and Consolidation Tests
Design and Construction Control

MOBILE LABORATORIES

193 West Shore Avenue
Bogota, New Jersey

JONES HENRY & WILLIAMS*Consulting Sanitary Engineers*

Water Works
Sewerage and Treatment
Waste Disposal

Security Bldg. Toledo 4, Ohio

EDWARD C. JORDAN CO., INC.*Civil & Sanitary Engineers*

Sewerage • Sewage Disposal • Industrial Wastes
Drainage • Water Supply • Streets • Highways
Municipal Engineering

Investigations—Reports—Designs—Supervision

379½ Congress St., Portland, Maine
Tel. SP. 4-0315

KENNEDY ENGINEERS*Complete Public Works Engineering*

◆ Water Supply
◆ Sewage and Waste Treatment
◆ Sewage Reclamation
◆ Utilities Planning

CHEMICAL and BIOLOGICAL LABORATORY
SAN FRANCISCO

Los Angeles Tacoma Salt Lake City

KEIS & HOLROYD*Consulting Engineers*

(Formerly Solomon & Keis)
Since 1906

Water Supply, Sewage Disposal, Garbage &
Refuse Incineration, Industrial Buildings

Troy, N.Y.

FENTON G. KEYES ASSOCIATES*Consulting***ARCHITECT—ENGINEERS**

Providence 3, R.I. Waltham 54, Mass.

KING & GAVARIS*Consulting Engineers*

Bridges Highways Toll Roads
Arterials Foundations
Reports Investigations Surveys
Supervision of Construction

425 Lexington Ave. New York

MORRIS KNOWLES INC.*Engineers*

Water Supply and Purification, Sewage
and Sewerage Disposal, Industrial Waste,
Valuations, Laboratory, City Planning

1312 Park Building, Pittsburgh 22, Pa.

DANIEL KOFFLER AND ASSOCIATES*Consulting Engineers*

Structural, mechanical and sanitary engineering
Bridges, special structures, cold storage ware-
housing, industrial developments, parking garages
and airplane hangars.

Dupont Blvd. and Washington Ave.
New Castle, Del.

LADD ENGINEERING CO.*Consulting Engineers*

Sewers, Water, Paving,
Filter Plants, Disposal Plants,
Electric Systems

Southeastern States

Home Office: FORT PAYNE, ALA.

FOR RATES FOR THIS SPACE

write

PUBLIC WORKS MAGAZINE

200 So. Broad St. Ridgewood, N.J.

souri River and spilled over that wall into the Missouri River, which was from 12 to 16 feet lower, in a continuous waterfall.

As our field forces retreated from the wall of water, they reached the point at Second and Grand, which is the break point between the watershed of the Central Industrial District and the Northeast Industrial area. At that point, through terrific effort, we were able to build a dam and prevent floodwater from reaching the Northeast area. Failure to accomplish this closure would have resulted in losing our last supply of water and power and would have caused terrific loss to the many industries in that area.

Another experience was our effort to save our Municipal Airport. That airport lies in the bend of the Missouri River directly opposite the mouth of the Kansas River. The full force of the flooding Kansas River was directed at the river slope of the airport levee. When it became evident that there was erosion of the toe of the levee, we caused quarries in that area to open full blast and by a call for dump trucks started a caravan of rock trucks almost bumper to bumper to the site. As fast as we dumped rock into the area of damage, it disappeared from the effects of the tremendous eddy or whirlpool.

Such situations will not permit time for surveys, estimates, commitments, and all the procedures which plague us; but someone came up with the idea of dumping old car bodies into the area. We had a large number of cars which had been impounded as completely abandoned on the city streets; we quickly assembled a fleet of lowboys and large trucks and hauled forty automobiles to the site. With sledges, the men broke out all the glass and dozed the cars into the break. The flow of water through these cars caused the eddy to subside, and the rock which we then dumped in immediately began to toe. In a very short while we called the job complete and the airport safe.

I might mention this effort lasted through 72 hours and cost \$1,000 an hour, but we figured these costs after the job was done.

The entire flood effort is entirely too long to narrate further, but the dirty work came after the water subsided. There were thousands of dead animals strewn through the area from the stockyards and the hog feeding yards; debris of all sorts several feet deep over the entire area; all sewers filled with silt; all power, telephone, and fire alarm

conduits inoperative; plus the tremendous accumulation of water-soaked and damaged contents of the buildings which we allowed owners to push out into the streets for our carting away.

One of the facets of this recovery operation related to the Public Works Department was building inspections for structural damage; also safety of gas and electrical services before power could be restored. We established a branch office for the Commissioner of Buildings and Inspections in the area. The cities of Detroit and St. Paul loaned us building inspectors and electrical inspectors to supplement our staff. Among the many who aided us was the City Engineer of Winnipeg, Canada, who had just gone through a similar experience.

Should you ever have reason to anticipate such a situation or one similar from action of nature, make certain of: a) Information and alert procedure; b) chain of command warning; c) arrange for rapid mobilization; d) keep heavy equipment ready to move; e) know the availability of contract equipment; and f) maintain a highly efficient communications center.

After all of the six items have been provided, the really one important thing any Public Works Director needs is a highly efficient staff, all of whom are dedicated to their jobs.

This is part of a paper presented at the first Annual Meeting of the Missouri Chapter of the American Public Works Association at Columbia, Missouri.

• • •

Data On Fluoridation

The water supplies of 3,703 communities with a total population of over 42,000,000 people contain fluorine either naturally or through controlled addition. This indicates that one of every three people in the country using central water supplies now drinks fluoridated water in sufficient quantity to prevent two out of three dental cavities.

Average Speed on Rural Roads

The Bureau of Public Roads has reported that the average speed on main rural highways in 1958 of 51.5 mph was only 0.1 mph above the 1957 average. The average speeds for passenger cars, trucks and buses were 52.6, 47.1 and 53.2 mph, respectively. This represents a slight increase in speed for trucks and buses, but the speed of passenger cars was the same as during 1957.

THE LOZIER COMPANY

Consulting Sanitary Engineers

Sewerage, Sewage Disposal, Water Supply, Water Purification, Refuse Disposal

10 Gibbs Street Rochester 4, N.Y.

FOR RATES FOR THIS SPACE

Write

PUBLIC WORKS MAGAZINE

280 So. Broad St., Ridgewood, N.J.

EMMET J. McDONALD & ASSOCIATES

CONSULTING ENGINEERS

HIGHWAYS, MUNICIPAL, SURVEYS

ELECTRONIC COMPUTATIONS

55 E. Cuyahoga Falls Ave. Akron 10, Ohio

GEORGE B. MEBUS, INC.

Consulting Engineers

Sewerage — Industrial Wastes
Water Supply — City Planning
Investigations and Reports
Design and Supervision of Construction
Valuations

Grand Street Trust Co., Bldg.
Glenside, Pa.

MERRITT & WELKER

Engineers

Water, Sewer, Streets, Roads, Natural Gas,
Valuations, Municipal Planning

208 Roswell Street Marietta, Georgia

METCALF & EDDY

Engineers

Water, Sewer, Drainage, Refuse and
Industrial Wastes Problems
Airports Laboratories Valuations

Statler Building
Boston 16

MORAN, PROCTOR, MUESER & RUTLEDGE

Consulting Engineers

Foundations for Buildings, Bridges and Dams;
Tunnels, Bulkheads, Marine Structures;
Soil Studies and Tests, Reports,
Design and Supervision

415 Madison Ave. New York 17, N.Y.
Eldorado 5-4800

GEORGE V. R. MULLIGAN, P.E.

Management Consultant

Operation Analysis
Manpower Utilization
Management Controls

601-19th Street, N.W. Washington, D.C.

NUSSBAUMER-CLARKE and VELZY

Consulting Engineers

Sewage Treatment—Water Supply
Incineration—Drainage—Highway Planning
Appraisals and Rate Studies

327 Franklin St., Buffalo 2, N.Y.
500-5th Ave., New York 36, N.Y.

O'BRIEN & GERE

Consulting Engineers

Water Supply, Treatment, and Distribution
Sewerage and Sewage Treatment
Industrial Waste Treatment—Flood Control
and Drainage
Rate Studies—Development Planning—Surveys
400 East Genesee Street Syracuse 2, N.Y.

PARSONS, BRINCKERHOFF HALL & MACDONALD

Civil and Sanitary Engineers

Water, Sewer, Drainage and
Industrial Waste Problems.
Structures—Power—Transportation

165 Broadway New York 6, N.Y.

FOR RATES FOR THIS SPACE

Write

PUBLIC WORKS MAGAZINE

200 So. Broad St., Ridgewood, N.J.

MALCOLM FIRNIE ENGINEERS

Civil & Sanitary Engineers

Malcolm Pirnie Ernest W. Whitlock
Robert D. Mitchell Carl A. Aremander
Malcolm Pirnie, Jr.
Investigations Reports, Plans
Supervision of Construction and Operations
Appraisals and Rates

25 W. 43rd St. New York 18, N.Y.

THE PITOMETER ASSOCIATES, INC.

Engineers

Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Water Measurement and Special
Hydraulic Investigations

90 Church St., New York City

PRAEGER-KAVANAGH

Engineers

128 E. 38th St. New York 16, N.Y.

HAROLD S. PRESCOTT

Consulting Engineers

Water Supply & Treatment Plants,
Sewerage & Sewage Disposal, Industrial Wastes;
Investigation & Reports; Design;
Supervision of Construction & Operation;
Municipal Consultants.

594 Main Street Placerville, California

RADER AND ASSOCIATES

Engineers—Architects

Water Works, Sewers, Sewage Disposal and
other Public Works Projects, Hotels, Office,
Industrial and Commercial Buildings
Plans, Specifications, Supervision, Reports
Investigations, Consultations
Aerial Photography, Photogrammetry
The First National Bank Bldg., Miami 32, Florida
Phone Franklin 1-3551

ROY EDWIN RAMSEIER AND ASSOCIATES

Sanitary and Hydraulic Engineers

Water Supply, Treatment, Distribution
Sewerage and Sewage Treatment
Chemical and Bacteriological Laboratories

1539 Solano Avenue, Berkeley 7, California

DALE H. REA
Consulting Engineers

Water Supply and Treatment Sewage Collection and Treatment Irrigation, Reservoirs and Dams, Airports, Buildings and Bridges Appraisals - Reports - Specifications Supervision of Construction
2200 West Chenoaga Littleton, Colorado
P.O. 4-3546

RIPPLE AND HOWE, Inc.
Consulting Engineers
APPRAISALS AND REPORTS
DESIGN AND SUPERVISION

Water Works Systems, Filtration Plants, Irrigation and Drainage Systems, Reservoirs and Dams, Sanitary and Storm Sewer Systems, Sewage Treatment Plants, and Refuse Disposal.
O. J. Ripple V. A. Vaseen B. V. Howe
833 23rd St. Denver 3, Colo.

RUSSELL AND AXON
Consulting Engineers

Civil-Sanitary-Structural
Industrial-Electrical
Rate Investigations
408 Olive St., St. Louis 2, Mo.
Municipal Airport, Daytona Beach, Fla.

CARL SCHNEIDER
Consulting Engineers

Incineration Sanitary Pills
Refuse Collection Sanitation Studies
Reports
602 Pan American Bldg.
New Orleans 12, La.

IRBY SEAY COMPANY
Engineers-Consultants

Water Supply & Treatment Natural Gas Systems
Sewage System & Treatment Electrical
516 Goodwyn Inst. Bldg. Phone Jackson 7-2932
Memphis, Tennessee

**SEELYE STEVENSON VALUE
& KNECHT**

Consulting Engineers
Richard E. Dougherty, Consultant
Civil, Mechanical, Electrical
Airports, Highways, Bridges, Industrial Plants, Dams, Water Supply, Sanitation, Tunnels, Piers, Reinforced Concrete, Steel
101 Park Avenue New York 17, N.Y.

SERVIS, VAN DOREN & HAZARD
Engineers-Architects

Investigations • Design • Supervision of Construction • Appraisals
Water • Sewage • Streets • Expressways • Highways • Bridges • Foundations • Airports • Flood Control • Drainage • Aerial Surveys • Site Planning • Urban Subdivisions • Industrial Facilities
Electrical • Mechanical
2910 Topeka Blvd. Topeka, Kansas

SMITH & GILLESPIE
Municipal and Consulting Engineers

Water Supply, Water Purification
Sewerage, Sewage Disposal, Drainage
Refuse Disposal, Gas Systems, Power Plants
Airports
Jacksonville Florida

FOSTER D. SNELL, Inc.
29 West 15th St., New York 11, N.Y.
WATKINS 4-8800

Chemists, Engineers, Bacteriologists, Toxicologists, Market Research.
10 stories of laboratories with a staff of over 130.
YOUR INQUIRY ANSWERED PROMPTLY

SOIL TESTING SERVICES, INC.
Consulting Engineers

CARL A. METZ JOHN P. ONAEDINOER
Soil Investigations
Foundation Recommendations and Design
Laboratory Testing
1827 No. Harlem Ave. Chicago 35, Ill.
San Francisco Milwaukee, Wis.
Havana, Cuba Portland, Michigan

SPRAGUE & HENWOOD, INC.
Drilling Services

Foundation Investigations Test Boring
Grout Hole Drilling and Pressure Grouting
Diamond Core Drilling
221 W. Olive St., Scranton, Pa.
New York, Philadelphia, Pittsburgh, Atlanta
Grand Junction, Colorado
Buckham, Newfoundland

**STANLEY ENGINEERING
COMPANY**

Consulting Engineers
Harvey Building Muscatine, Iowa
208 S. LaSalle St. Chicago 4, Illinois
1154 Hanna Building Cleveland 15, Ohio

ROBERT H. STELLWAGEN

Consulting Engineer
Municipal and Industrial Waste Problems
Collection, Incineration, Salvage, Pumping,
Treatment, Testing
429 Buhl Bldg. Detroit 26, Mich.

**ALDEN E. STILSON &
ASSOCIATES**

Consulting Engineers
Water Supply, Sewerage, Industrial Waste
Bridges-Highways-Industrial Structures
Mechanical & Industrial Layouts & Studies
Land Use Planning & Industrial Parks
245 N. High St. 75 Public Square
Columbus, Ohio Cleveland, Ohio

**SUHR, PETERSON,
PETERSON & SUHR**

Consulting Engineers
REPORTS-PLANS-SUPERVISION
Sewerage, Water Supply, Flood Control
and Drainage, Airports, Roads, Surveys,
Fixed and Movable Bridges
130 N. Wells St. Chicago 6, Illinois

THOMPSON SURVEY SERVICE
Civil Engineer - Registered Surveyor

Land Subdivision
Construction and Topographic
Surveys and Municipal Engineering
JOHN M. THOMPSON
3987 Northern Pike, Monroeville, Penna.

UHLMANN ASSOCIATES

H. E. BONHAM NYE GRANT
CARL E. KUCK J. M. BRUNDAGE
Consulting Engineers
Sewage and Industrial Waste Treatment
Water Supply and Purification
4954-58 N. High St. Columbus 14, Ohio

JOSEPH S. WARD
Consulting Soil and
Foundation Engineer

Site Investigation, Boring Supervision, Laboratory Soil Testing, Foundation and Pavement Analysis and Design, Construction Supervision, Engineering Reports and Consultation.
91 Roseland Avenue Caldwell, N.J.

J. STEPHEN WATKINS
J. S. Watkins G. B. Watkins
Consulting Engineers

Municipal and Industrial Engineering, Water Supply and Purification, Sewerage and Sewage Treatment, Highways and Structures, Reports, Investigations and Rate Structures.
446 East High Street Lexington, Kentucky
Branch Office
4726 Preston Highway Louisville, Kentucky

WEINBERG & CUNNINGHAM
Engineering Consultants

Water Supply, Treatment & Foundations
Distribution Highway & Traffic
Sewage Treatment & Disposal Industrial & Municipal
Industrial Waste Treatment Buildings
Investigations, Reports, Appraisals, Rates, General
Public Works Engineering
134 EAST THORNTON STREET, AKRON 11, OHIO

ROY F. WESTON, INC.
ENGINEERS-BIOLOGISTS-CHEMISTS

Industrial Wastes-Stream Pollution
Air Pollution-Water-Sewage
Surveys-Research-Development-Process
Engineering-Plans and Specifications
Operation Supervision-Analyses
Evaluations and Reports
NEWTOWN SQUARE, PA.

**WALTER H. WHEELER
EM., M. A. S. C. E.**

Designing and Consulting Engineer
Buildings Bridges, Mfg. Plants, Etc.
Inventor "Smooth Ceilings" Flat Slab
Construction
802 Met. Life Bldg. Minneapolis, Minn.
Tel. Federal 3-1019

FOR RATES FOR THIS SPACE

Write
PUBLIC WORKS MAGAZINE

200 So. Broad St., Ridgewood, N.J.

**WHITMAN, REQUARDT
and Associates**

Civil-Sanitary-Structural
Mechanical-Electrical
Reports, Plans, Supervision, Appraisals
1304 St. Paul St., Baltimore 2, Md.

**CLYDE E WILLIAMS &
ASSOCIATES, INC.**

Aerial Mapping
Civil & Sanitary Engineering
312 W. Colfax Ave., South Bend 1, Ind.
720 E. 38th St., Indianapolis 5, Ind.

WILSEY & HAM
Engineers & Planners

Water and Sewage Works
Flood Control and Drainage
Airports, Traffic Studies and Bridges
City and Regional Planning
111 Rollins Road, Millbrae, Calif.
800 W. Colorado Blvd.,
Los Angeles 41, Calif.

WILSON & COMPANY
Engineers

Water, Sewerage, Streets, Highways, Dams,
Bridges, Electrical, Airfields, Drainage,
Treatment Plants, Industrial Installations.
Chemical Testing Lab - Aerial Mapping
Electronic Computer Service
631 E. CRAWFORD SALINA, KANSAS

PUBLIC WORKS EQUIPMENT NEWS

1-Ton Asphalt Roller

The Ellis asphalt roller carries a propane tank, supplying fuel to burners within each roller. It is the application of heat which enables the Ellis roller to achieve the greater compaction; and, the testing laboratory reports show that the mix temperature is not as critical when using the heated roller. A 7 hp air-cooled Wisconsin engine powers the unit through a chain drive to the rear roller. Front roller is 18-in.; rear roller is 21-in. diameter and steering is achieved through a worm gear. Additional information from Ellis Mfg. Co., Liberty, Mo., or circle No. 10-1 on the reply card.

Making Continuous Concrete Pipe

For building concrete pipe in place, a process and necessary equipment have been developed to lay 12 to 30-inch pipe; and build-



ing of larger pipes is being tested and developed. The process includes an inside form which is inflated for use and deflated for pulling forward as soon as the concrete has taken its initial set. A tamping device is provided to insure a complete fill of uniformly placed concrete. An interesting reprint is available from Fullerform Inc., 24 East Pioneer St., Phoenix, Ariz., or circle No. 10-2 on the reply card.



Maximum GVW ratings on 1960 model Ford F-600 are increased to 21,000 lbs.

1960 Ford Truck Models

Information is now available covering the 1960 Ford truck lines, including 200 models in six series of the light and medium trucks; as many models of heavy and extra heavy trucks; Ford truck engines; styling and other data. A glossary of truck terminology is of interest and value. The light and medium trucks range from 4,600 to 21,000 pounds GVW; the heavier units range from 22,000 to 51,000 pounds

GVW, with gross combination weight for tractor applications from 35,000 to 75,000 lbs. The new engines range from 223 to 534 cu. inch displacement and provide a very high horsepower to weight ratio. Some of the features of the new trucks are shown herewith. For details see the local Ford dealer. Write Truck News Bureau, Ford Div. of Ford Motor Co., Box 608, Dearborn, Mich., or circle No. 10-3 on card.

"Aircomb" Diffuser with Self-Cleaning Non-Clog Teeth

The American "Aircomb" Diffuser with self-cleaning non-clog teeth is designed to give aeration where and when wanted. Teeth on both sides of the diffuser provide variable-flow orifices for controlled aeration. A peaked-dome design prevents accumulation of solids. Velocities are self-cleaning. Variable diffusion capacity is as high as 5:1 if necessary. It has useful applications in pre-aeration, channel diffusion, and activated sludge installations. A very wide range of gas flow can be handled per diffuser unit. Orifices adjust automatically to the gas flow (the gas-liquid inter-

face lowers as the rate increases). Bubble size is smallest at the lowest flow. It is cast in bronze, aluminum, cast iron, or any other necessary material. More information in Bulletin 415, The American Well Works, Aurora, Ill., or circle No. 10-4 on the reply card.



Skid Shovel



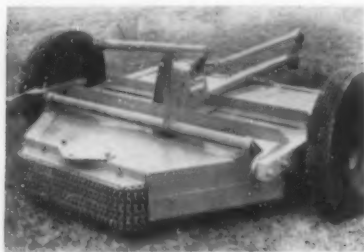
Versatile IHC Drott 4-in-1 shown on a stripping job.

The International Drott 4-in-1 Skid-Shovel—a front-end loader which duplicates the actions of four specialized machines—has been adapted for use with the new T-340. The segmented-type bucket can serve as a standard bucket, bulldozer, carry-type scraper and clam-shell. Selection of the desired action is made from the tractor seat by means of a selector lever, and changeover takes only seconds. The 4-in-1 has ability to work in tough or frozen soil, and to pry out stumps, boulders, old foundations, concrete

pavement and other heavy and deeply imbedded materials. With a capacity of $\frac{3}{4}$ cy. struck and $\frac{1}{4}$ cy. heaped, the bucket dumps in two ways, by the conventional roll-forward action or through the bottom by lifting the front half of the bucket and letting the material fall through. More information from your International dealer; from Consumer Relations Dept., International Harvester Company, 180 No. Michigan Ave., Chicago 1, Ill., or by circling No. 10-5 on the reply card.

Rotary Mower with Chain Guard

This heavy duty five-foot trail or mounted rotary mower is designed especially to meet highway specifications. The unit has hardened spring steel, free swinging blades with side constructions of 5/16 heavy duty angle. A safety chain arrangement provides maximum safety for mowing along highways or in congested areas. The chains across the front and rear of the mower prevent materials from being ejected at high velocity and assure a maximum safety for the operator. More information from Danuser Machine Works, Tulsa 14, Okla., or circle No. 10-6 on the reply card.



Rotary mower meets highway specs.

Sleep-Out



New coach body furnishes on-job living accommodations.

Engineers and construction men can now "sleep out" on the back of a pick-up truck—with complete home comfort. The Dreamer, a custom-built coach, can be mounted on any pick-up. It is constructed of kiln-dried white pine, covered with aircraft aluminum skin and painted to match the truck color. Coaches are fully insulated for summer or winter living. Birch finished interiors include complete galley with self-contained water system and icebox, plus dining area that converts into sleeping arrangement for three. More from Coons Custom Coach Mfg. Co., Oswego, Kansas, or 3935 Mission Blvd., Pomona, Calif., or circle No. 10-8 on the reply card.

1 Ton and 1½-2½ Ton Rollers

A new 1-ton tandem steel roller is built for utility and ease of use. It is equipped with two seats, one for going forwards, and one for going backwards. When the job requires a back and forth rolling pattern, the operator just changes seats so that he is facing the direction that he is rolling. This is particularly useful for small jobs where much maneuvering has to be done. There is less than ½-inch overhang on the roller which allows the operator to roll within ½ inch of posts, walls or curbs. Gledhill also makes a 1½ to 2½-ton tandem steel roller designed for heavier jobs and more rugged use. It too has the special minimum overhang feature that allows rolling to within ½ inch. Both the 1-ton and 1½- to 2½-ton Gledhill rollers are completely portable, and fully equipped with a custom built trailer. More information and specifications from Gledhill Road Machinery Co., Galion, Ohio, or circle No. 10-9 on the reply card.

IHC T-340 Crawler Tractor and Attachments

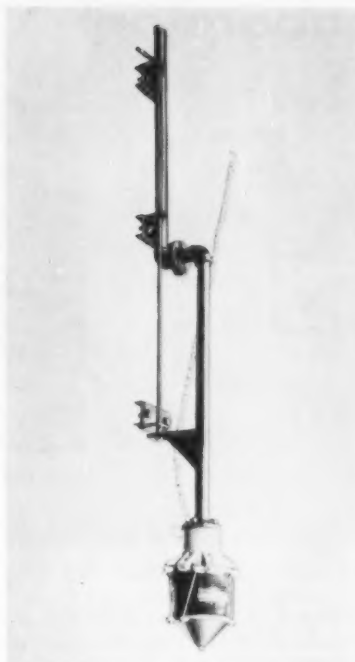
The International T-340 is a new 31 drawbar horsepower crawler tractor weighing 5,600 pounds. Traction, stability and maneuverability suit it for a wide variety of earthmoving and material handling jobs, landscaping, earthmoving close to foundations, home and building construction on hillsides and crowded areas, and work on uncertain or muddy terrain. The 340 handles such auxiliary equipment as International Wagner backhoes, loaders, blades and IH dozers, the International Drott 4-in-1 skid shovel and skid grapples, plus a full line of special duty equipment. The tractor has a four-cylinder gasoline engine with 135-cubic inch displacement that develops an estimated 45 gross engine flywheel horsepower to give a drawbar pull of 5,320 to 8,000 pounds, depending on weight and traction. There are 5 speeds forward and one reverse. More information from Consumer Relations Dept., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle No. 10-7 on the card.

Broadened Licensing for Accelerated Sludge Digestion

Broadened licensing under its patents, of the use of the CRP Accelerated Sludge Digestion System, through the specification of consulting engineers with gas recirculation equipment supplied by approved and experienced manufacturers, has been announced by Chicago Pump Company. The CRP Accelerated Sludge Digestion System, under United States Patent numbers 2,777,815 and 2,786,025 incorporates gas recirculation in digestion tanks for high-rate digestion and is currently in operation or being installed in 43 plants. Eight of the plants are operating with digestion volume equivalent to from one-third to one-fifth past low-rate practice, or at approximately two-thirds cubic foot per capita. Nine of the plant installations have been in operation in excess of three years. The CRP Accelerated Sludge Digestion System is recommended for design loadings up to 0.2 pound of volatile solids per cubic foot of digestion volume per day, equivalent to primary digestion volume of two-thirds cubic foot per capita for complete treatment plants or 0.45 cubic foot per capita for primary treatment plants. More data from Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill., or circle No. 10-10 on the reply card.

Eimco Crawler-Tractors

The Eimco 103 crawler is a 100-hp tractor incorporating many innovations. In addition to the up-front operator position for maximum visibility, an important feature is the "Quadra-Torque", which permits four gear selections in either forward or reverse, allowing shifts from any speed, or from forward to reverse and back again, at any engine or tractor speed and load. The 103 line will be produced as a bare tractor, six models of dozers, a front-end loader, special steel mill front end loader and a log loader. More data from Eimco Corporation, Salt Lake City 4, Utah, or circle No. 10-11 on the reply card.



Bridge light for use over navigable waters has an automatic lampchanger.

Bridge Navigation Light

Wallace & Tiernan has added a new bridge navigation light to its line of aids to navigation. The light is of solid construction, designed to withstand vibration from the heaviest traffic. Its four-place lampchanger is shock mounted to minimize filament failure. The special marine lamps used in the lampchanger have a burning life of 2,500 hours each. A sun or time switch attached to the light can control the hours when the bridge light is burning. The light may be pedestal or swivel mounted on abutments or superstructures. Another type, designed for lift bridges, features duplex lanterns which may be switched manually or automatically. Swivel mounted lights are locked to prevent tampering, and can be easily raised to bridge level for maintenance. Complete data from Wallace & Tiernan Inc., Belleville, N. J., or circle No. 10-12 on the reply card.

Instrument Automatically Tests Water

An automated water testing instrument connected into one or several intake lines, will automatically draw off a pre-determined water sample, test it immediately, and record its findings on tape. Continual testing is thus possible, if desired. A major advantage is that the sample is drawn directly from the

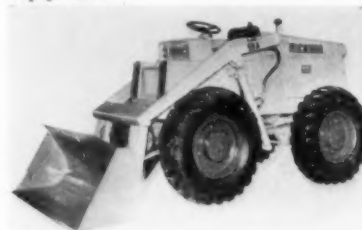
source of the water. This eliminates a time lag between obtaining a sample and carrying out the test. In addition, the tester can be set to draw from as many different pipelines as desired, in rotation, testing each source in turn and returning to the first source, continually repeating the cycle. A prime index in determining the condition of surface water is the dissolved oxygen content, the continual recording of which provides an around-the-clock check of raw water quality. Complete literature on the Mark II unit is available. Write Stan Dodd, Technical Director, Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago 22, Ill., or circle No. 10-13 on the reply card.

Heavy Duty Steam Cleaners

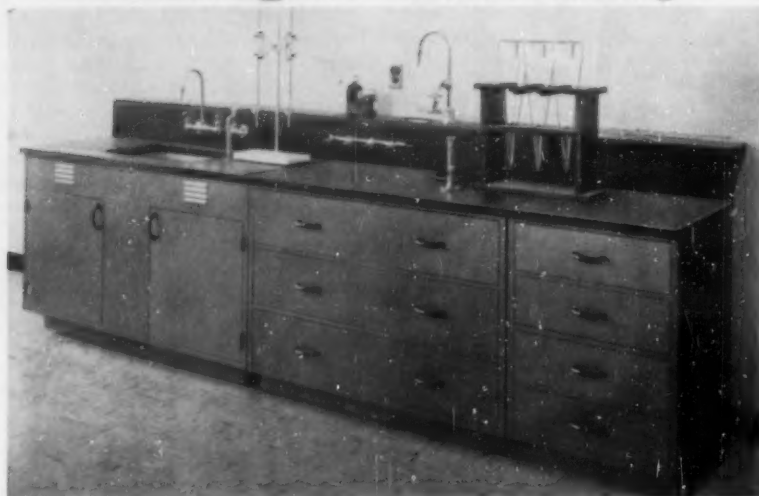
A 600-gallon per hour steam cleaner designed for heavy duty use has a down draft burner and a 15,000-volt transformer to provide constant ignition. It features a chemical by-pass system. Cleaning chemicals by-pass the heating coil permitting use of less expensive compounds and prevent coil clogging problems. Two cleaning guns and one rinse gun are provided as standard equipment. This unit, the CLS-600, is described in Bulletin CL-6. Write Aeroil Products Co., Inc., 6 Wesley St., South Hackensack, N. J., or circle No. 10-14 on the reply card.

Four-Wheel Drive One Yard Tractor Shovel

A new 26-mile per hour, 1-yd. capacity tractor shovel by Clark Equipment has four-wheel drive, is a completely roadable all-wheel drive tractor shovel for city, county, and state governmental agencies, contractors, and others with similar material handling problems. It has a 66.5 hp. gasoline engine and a working weight of 10,500 pounds. It will lift and carry up to 7000 pounds. Low pressure, wide base tubeless tires are standard equipment; abrasive resistant rock tires are available. More from Construction Machinery Div., Clark Equipment Co., Pipestone Road, Benton Harbor, Mich., or circle No. 10-15 on the reply card.



Packaged Laboratory



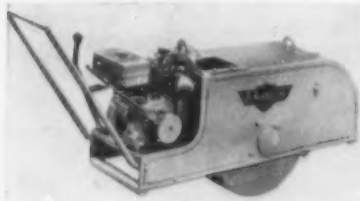
Complete laboratory set-up for sewage plant analyses is furnished in four sizes.

This sewage testing unit contains everything needed for up-to-date waste water analysis in sewage disposal plant laboratories; neatly and systematically organized by specific tests. All materials necessary for the tests—from a BOD incubator and a microscope to a red wax pencil—can be obtained on one order from one source. The "packaged" laboratory provides for the analysis of incoming sewage, digester products, sludge and effluent. There are four

different models, complete with all the furniture, instruments, apparatus and chemicals required for a standard test program; No. 1 for the small plant (population under 7500); No. 2 for the large, primary-treatment plant; No. 3 for the medium-size secondary-treatment plant; and No. 4 for the large secondary-treatment plant. Full data from Fisher Scientific Co., 717 Fisher Bldg., Pittsburgh 19, Penna., or circle No. 10-16 on the reply card.

Self-Propelled Vibrating Compactor

Compaction on soil equivalent to a 16-ton static weight roller is provided by a new vibrating compactor designed for work in close quarters, trenches, ditches, around foundations and in other difficult areas. Being self-propelled, it requires only guidance by the operator. It is capable of high density asphaltic compaction for highway maintenance and patching. When used for both ditch backfilling and the asphalt topping patch, its high density compaction completely eliminates future settling, and the need for temporary asphalt patches. Final asphalt is im-



One-man size vibratory compactor.

mediately applied. On any type asphalt application, density is complete, and the patch is ready for immediate traffic. With a 4.8-hp. air cooled engine, it weighs 630 lbs. For asphalt use, a sprinkler tank, spray bars, and cocoa mat can be furnished. More data from Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles 21, Calif., or circle No. 10-17 on the reply card.

Caterpillar D9 Series E Tractor & Matched Equipment

Prime improvements in the new D9 Tractor are concentrated in the under-carriage components. The track group is completely new, with dimensional increases and strengthening of all components. The track link pitch has been increased from 9 to 10¼ inches. The track link height is increased 5/16 inch to 5 9/16 inches, providing a stronger link. Track pin diameter has increased to 2¼ inches, making it 40 percent stronger. These improvements increase the life by providing better surface contact. In helping

provide the higher horsepower rating of the new D9, now 335 hp., a new turbocharger has been incorporated. The recently-announced improved No. 9 Ripper, with five-position clevis, will be offered for the new tractor. Power shift transmissions provide instantaneous, one-lever control of gear shifting without interruption of power and momentum. On the operator's desk, one range selection lever now takes the place of the flywheel clutch lever, gear selection lever and forward-reverse lever. This means reduced shifting time and simplified shifting. More data on this and the D8 from Caterpillar News Service, Peoria, Ill., from any Caterpillar Dealer or by circling No. 10-18 on the reply card.



ward-reverse lever. This means reduced shifting time and simplified shifting. More data on this and the D8 from Caterpillar News Service, Peoria, Ill., from any Caterpillar Dealer or by circling No. 10-18 on the reply card.

Ditch Witch Trencher

New 12-horsepower model M-322 Ditch Witch trenches to 5-ft. depths and 12-inch widths. The model M-322 can be used for foundation footings, sewer laterals, drain fields (double cut trench), water lines to



Compact trencher cuts 5 ft. deep.

5-foot cover, gas services and main extensions, underground telephone cable installation, oil field gathering systems and salt water lines and many others. This model is powered by a Wisconsin AGN 12-hp. air cooled engine. It will dig ditches 5 feet deep, 4 inches wide; 4 feet deep, 6 inches wide; 3½ feet deep, 8 inches wide; 3 feet deep, 10 and 12 inches wide, in any soil. More from Witch Marketing Co., 1959 West Fir Ave., Perry, Okla., or circle No. 10-19 on the reply card.

Snow Removal by Melting

The Thermal Snow Melter System is a new concept and the data available in the bulletin on which this item is based are interesting. For instance, to determine the probable weight of snow on an area, multiply the area in sq. ft. by half the snow depth in inches to get the pounds of snow. This is based on an average snow density of 6 pounds per cu. ft. Using a submerged combustion burner in a small pit, 25 tons of snow are melted per hour. An 8-in. snow on a 100-car parking lot is removed in 4 hours. It is estimated that 25 tons of snow can be disposed of for less than \$10 cost for fuel and power. More data and interesting bulletins from Thermal Research & Engrg. Co., Conshohocken, Pa., or circle No. 10-20 on the reply card.

Custom Snow Plow Attachment

A snow plow for Ford four-wheel drive trucks, Model ST-84, features a 7 foot, reversible, spring trip blade with replaceable cutting edges. During the original installation, all brackets, plates and braces can be attached to the truck in about four hours. Between snows, the blade can be removed or replaced in minutes. For more information, write to Meyer Products, Inc., 18513 Euclid Ave., Cleveland 12, Ohio, or check No. 10-21 on the reply card.



New Meyer plow mounts on Ford Truck.

1960 Dodge Trucks



Built for the job, 1960 Dodge D200 Tradesman fits needs of municipal work crews.

The 1960 line of Dodge trucks includes 140 basic models, conventional, cab-forward, 4-wheel-drive, forward-control, school bus chassis, and tandem units. There are 11 gasoline engines, with a horsepower range from 113 to 228; and four diesel engines, with a horsepower range from 175 to 220. Front fenders on 1960 Dodge cab-forward trucks swing out 110 degrees at the

release of a single latch to provide instantaneous access to the engine. Gross vehicle weights range to 53,000 pounds. Gross combination weights range to 76,800 pounds. The 1960 Sweptline half-ton pick-up features a larger cubic load capacity and bigger brakes. More from Dodge Truck News Bureau, 2751 East Jefferson, Detroit 7 Mich., or circle No. 10-22 on the reply card.

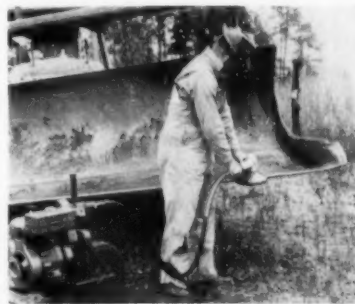
Indirect Fired Portable Heater

An oil furnace on wheels blows air around the outside of a completely enclosed combustion chamber producing heated fresh air instantly and in large volume. Fumes can be vented out the top, thereby meeting any safety specifications. Ducts can be provided to pipe heat to a specific area for spot heating. Model S200ID produces 200,000 btu of heat at a rate of 1600 cu. ft. of warm air per minute and Model S420ID produces 420,000 btu at a rate of 4500 cu. ft. of air/min. The S420ID has a built-in room thermostat, permitting selection of the desired temperature. No attendant is required since safety controls anticipate any emergency. The fire goes out immediately when the thermostat switch is snapped off or power is cut off. More information from Stow Mfg. Co., 290 Shear St., Binghamton, N.Y., or circle No. 10-23 on the reply card.

Sharpeners for Clearing Blades

Two new portable grinders for sharpening Rome K/G clearing blades are completely self contained and require no external power source. Thus, an operator can quickly and easily sharpen the cutting

edge at any time or place, eliminating the need for moving the equipment, or bringing in heavy grinder equipment. One grinder is a lightweight gasoline engine powered unit weighing only 28 lbs. and utilizing a 9-in. reinforced Carborundum disk with depressed center. The other is a heavier duty model, driven by a 7-hp engine through a 6-ft. flexible shaft. This unit also has a similar 9-in. disk grinding wheel. Both units have sufficient capacity to sharpen a blade in approximately 15 minutes. More from Rome Plow Co., Cedartown, Georgia; any Rome-Caterpillar Dealer; or circle No. 10-24 on the reply card.



Field sharpening with portable unit.

Sealed Electrode Floatless Pump Controller

Sealrode sealed electrode floatless pump controllers have these advantages: Electrodes never become insulated and coated with grease, oil or soap; electrodes are never affected by corrosive elements in sewage and drainage water; there are no moving parts in liquid; the original cost is low; their use elimi-



nates the need for duplex float switches and float guide pipes; maintenance cost is low. Complete data in Bulletin 128-A. Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill., or circle No. 10-25 on the reply card.

Utility Tractor and Blacktop Spreader

An industrial utility tractor, the 65 Utility, is announced by Massey-Ferguson Industrial Division. The 54.5 hp unit is designed to handle industrial and construction jobs with a variety of power-matched attachments including Massey-Ferguson's Davis loader, backhoe, and scarifier-scraper. It features a dual range transmission with six speeds forward and two reverse, with hydraulic draft control for 3-point attachments, and a two-stage industrial clutch that permits operation of the control and P.T.O. when the tractor is not in motion.

A blacktop spreader attachment for the Work Bull 1001 tractor shovel is also announced by Massey-Ferguson. Easily installed or removed, the spreader can use asphalt or oil mix, hot or cold, with crushed

rock or aggregate any size up to $\frac{3}{4}$ ". It is particularly suitable for patching jobs or paving of alleys, driveways, parking lots, drive-ins, service stations. It operates off the Work Bull 1001's hydraulic system through its own hydraulic motor. It rides on pneumatic tires with hydraulic height adjustment. Its maneuverability enables the rig to surface odd-shaped areas, and it can be adjusted to spread any width up to eight feet and any thickness up to six inches. For further information, write Massey-Ferguson Industrial Division, Block 1000 South West St., Wichita, Kans., or circle No. 10-26 on the reply card.

Direct Drive Chain Saw

A direct-drive chain saw, called the "BUZ", weighs only 19 pounds, less bar and chain, but will cut through 16-inch trees in 16 seconds,



and fell trees up to 3 feet in diameter. Among its uses are cutting firewood or fence posts; clearing campsites; repairing storm damage; pruning and trimming; building shelters; clearing land and maintaining rights-of-way. Powered by the Homelite engine, it is available with 12, 17 and 21-in. straight blades. Trees can be cut off level with the ground, eliminating stumps. More data from Homelite, Port Chester, N.Y., or circle No. 10-27 on the reply card.

Electro-Pneumatic Control Unit

Synchro-Start Products, Inc., has designed an electro-pneumatic control unit (1458 series) which gives accurate cranking cycles as well as protection for gas, gasoline, or diesel engines. Each of the three electro-pneumatic units (cranking cycle, rest cycle, and total cranking cycle) are individually adjustable from 0 seconds to 120 seconds. Being pneumatic, the units keep precision timing regardless of the battery's volt-

age variations. A switch on the front panel gives the choice of "Automatic", "Off", or "Manual Operation". Warning lights are also mounted on the panel for "Over Crank", "Oil", "Water", and "Over Speed". When requesting information on these controls, please ask for Bulletins 501 and 501-S, including pertinent data regarding the engine and the installation you have in mind. Write Synchro-Start Products, Inc., 8151 N. Ridgeway Ave., Skokie, Ill., or circle No. 10-28 on the reply card.

Surveying Instruments for Builders

A new surveying instrument for builders, features aluminum alloy standard and base construction. A European-type, wide-frame tripod will be sold for use with the new level-transit and a shock resistant, fiberglass carrying case will complete the package. Among the features of this level transit are a stamped horizontal circle for easier reading and a smoother finish which makes it easier to clean. A construction level of similar styling with enclosed base and smooth-surface finish is also available. The new instruments have rack-and-pinion, internal, either-hand focusing, a built-in sunshade and a 12-power optical



system. The level-transit has a positive level lock bar. More from David White Instrument Co., 2051 N. 19th St., Milwaukee 5, Wis., or circle No. 10-29 on the reply card.

Controlling Brush and Deep Rooted Weeds

A new weed and brush killer, named "Urab", is effective against scrub oak, wild hickory, sassafras, poison sumac and other weed-trees. It will also control such weeds as trumpet vine, briars, cattails, Can-

ada thistle and all types of brush. This weed killer penetrates soil as readily as the water it is dissolved in, thus reaching the deep root zone. Its movement in the soil is downward rather than lateral. It is designed for use in non-crop areas such as right-of-ways, industrial sites, tank farms, storage areas, railroads, and parking lots. The toxic killing ingredient is 3-phenyl-1, 1-dimethylurea trichloroacetate, which is soluble in water. Its use is not recommended for areas into which the roots of desirable plants extend. It should be applied by experienced and professional operators. More from General Chemical Division, 61 Broadway, New York 6, N.Y., or circle No. 10-30 on the reply card.

Extended Lift Arms for Terraload'rs

Extra-long lift arms to provide greater clearance for dumping into high-sided trucks, railroad cars and tall hoppers are now available as

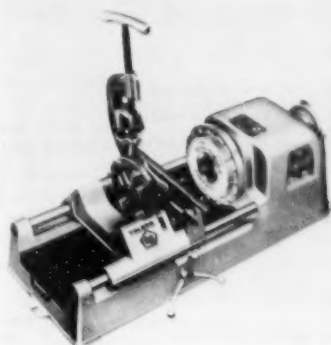


optional equipment on Case W-9 and W-10 Terraload'rs. The new arms are 2 ft. longer than standard and give both loaders a clear dump height of 11'6" with bucket retracted, and 10'2" with bucket fully dumped. Forward reach at 7-ft. lift height is 89". Standard SAE rated bucket sizes for the new high-lift models are 1 1/4 cu. yd. for the W-9 and 1 3/4 cu. yd. for the W-10, with 1 1/2 and 2 cu. yd. buckets available for handling light materials. Carry capacities at 4 mph are 3,750 for the W-9 and 4,500 lbs. for the W-10, compared with 6,000 and 6,500 lbs. for standard models. More data from J. I. Case Co., Industrial Division, Racine, Wis., or circle No. 10-31 on the reply card.

Power Pipe Threading, Cutting and Reaming Tool

A new power pipe machine is designed for threading, cutting and reaming all sizes of pipe through 2" and for threading 1/4" to 1 1/2" bolts. Special features include ability to

use the die head, cut off tool and reamer as close as 3/4 inch from the chuck; an offset roller cutter to provide maximum visibility of the work



area resulting in accurate cut-off; a carriage travel of 10 inches minimum; and interchangeability of chuck, centering device and gear train with other Toledo power machines. For more data, write Toledo Pipe Threading Machine Co., Toledo, O., or circle No. 10-32 on the reply card.

Concrete Hopper Attachment For Hi-Lifter

A concrete hopper, an attachment for the Hi-Lifter fork truck, is available in 1/2 and 3/4-yard sizes. The attachment is a fork-entry unit that slips on over the forks and is easily attached or detached. It is all-steel welded and designed for fast discharge. The door is operated by a lever and can be closed for partial discharge. The 3/4-yard hopper weighs 580 pounds. A hydraulically



controlled discharge door is available as an optional extra. More from the Kwik-Mix Co., Port Washington, Wis., or circle No. 10-33 on the reply card.

Standard for Flasher Warning Lights

Pacific Mercury is introducing a new street standard, designed for use with its new flasher warning lights. This has a heavy cast-steel base and a balanced design to insure stability and long life. The standard comes complete with "Go Slow" sign. To prevent light theft, warning lights can be locked onto the stand with a mounting lock and key. This is model 50-6053. It has been designed for use on construction projects, road or street hazards and for inplant warning signals. More information from Pacific Mercury, 14052 Burbank Blvd., Van Nuys, Calif., or circle No. 10-34 on the reply card.

NEWS OF ENGINEERS

EUGENE V. AVERY has been appointed Chief Engineer of the St. Paul, Minn., Department of Public Works, succeeding the late Arthur W. Tews. RICHARD L. WHEELER has been appointed Ass't. Chief Engineer. Mr. Avery has been City Traffic Engineer and Ass't Chief Engineer. Mr. Wheeler has been Public Works Maintenance Engineer.

EDWARD G. WETZEL, Special Ass't. to the director of Port Development, Port of New York Authority, has been elected president of the Institute of Traffic Engineers. Other officers are A. F. MALO, Director of Streets & Traffic, Detroit, and G. F. GRAVELLE, Deputy Commissioner of Traffic, New York City, vice presidents; and ROBERT A. BURCH, North Carolina State Highway Commission, secretary-treasurer.

FRANK A. MARSTON, Partner in Metcalf & Eddy, consulting engineers, Boston, is the new president of the American Society of Civil Engineers; C. B. MOLINEAUX and L. A. ELSNER are new zone vice presidents; District directors include ELMER K. TIMBY, S. S. BAXTER, T. M. NILES, T. R. DAMES, W. W. BAKER and BERNHARD DORNELATT.

J. W. VICKREY has been appointed State Highway Engineer of California. For the past three years he has been Deputy and he has been with the Department since 1917. He succeeds GEORGE T. MCCOY, State Highway Engineer since 1943.

INDEX OF ADVERTISEMENTS

| | |
|---------------------------------------|----------------|
| Acker Drill Co., Inc. | 132 |
| Alabama Pipe Co. | 155 |
| Allis-Chalmers | 8, 37, 39 & 41 |
| Aluminum Company of America | 68 |
| American Bitumuls & Asphalt Company | 127 |
| American Cancer Society | 41 |
| American Pipe & Construction Co. | 66 |
| American Playground Device Co. | 124 |
| American Steel and Wire | 64 & 65 |
| Div. of United States Steel | |
| Armco Drainage & Metal Products, Inc. | 73 |
| Asplundh Chipper Co. | 60 |
| Austin-Western | 48 |
| Construction Equipment Division | |
| Ayer-McCord Clay Co., Inc. | 12 & 13 |

| | |
|------------------------------|---------|
| B-I-F Industries, Inc. | 18 |
| Baldwin-Lima-Hamilton | 48 |
| Barber-Greene Co. | 133 |
| Blow-Knox Company | 53 |
| Blow-Knox Equipment Division | |
| Bowenston Shale Co. | 12 & 13 |
| Brackway Motor Trucks | 21 |
| Div. of Mack Trucks, Inc. | |
| Buffalo Motor Co. | 54 |
| Buffalo Pipe & Foundry Corp. | 26 |
| Burr Chemical Company | 124 |
| Byers Company, A. M. | 49 |

| | |
|----------------------------------|-------------|
| Connolly Sewer Pipe Co. | 12 & 13 |
| Cost Iron Pipe Research Assoc. | 8 & 9 |
| Caterpillar Tractor Co. | 4, 50 & 51 |
| Caterpillar Tractor Company | 30 & 31 |
| Engine Division | |
| Centiline Corporation | 74 |
| Chicago Bridge & Iron Co. | Third Cover |
| Chicago Pump Co. | 3 & 157 |
| Classified Ads | 184 |
| Columbia-Southern Chemical Corp. | 131 |
| Crown Zellerbach Corp. | 77 |

| | |
|-----------------------------|---------|
| Darley & Co., W. S. | 132 |
| Daybrook Hydraulic Division | 120 |
| Young Spring & Wire Corp. | |
| Deere, John | 47 |
| Industrial Division | |
| Dempster Brothers | 33 |
| Dicalite Department | 132 |
| Great Lakes Carbon Corp. | |
| Dickey Clay Mfg. Co., W. S. | 12 & 13 |
| Dow Chemical Company | 19 |

| | |
|-----------------------------|-----|
| Enten Manufacturing Company | 75 |
| Axle Division | |
| Emco Corporation | 78 |
| Ellis & Ford Mfg. Company | 147 |

| | |
|-----------------------------|-----|
| Fitchburg Engineering Corp. | 52 |
| Flexible Inc. | 142 |
| Flint Company | 135 |
| Flynn & Emrich Co. | 72 |
| Forneys Inc. | 132 |
| Frink Sno-Plows, Inc. | 58 |

| | |
|-------------------------------|--------------|
| Gallon Iron Works & Mfg. Co. | Second Cover |
| Gar Wood Industries, Inc. | 86 |
| General Electric Company | 83 |
| Communications Products Dept. | |
| Grace Sign & Mfg. Company | 88 |

| | |
|------------------------------------|---------|
| Hamilton Kent Mfg. Co. | 141 |
| Horsay Manufacturing Co. | 59 |
| Highway Equipment Company | 130 |
| Holan Corporation | 43 |
| Subsidiary of The Ohio Brass Corp. | |
| Hotel Jefferson | 41 |
| Hotel Pittsburgher | 44 |
| Hough Company, Frank G. | 14 & 15 |
| Huber-Warce Company | 28 & 29 |
| Hydrauger Corp., Ltd. | 46 |

| | |
|------------------------------|----|
| International Salt Co., Inc. | 10 |
|------------------------------|----|

| | |
|---------------|---------|
| John-Manville | 80 & 81 |
|---------------|---------|

| | |
|--|-----|
| Kaiser Aluminum & Chemical Sales, Inc. | 11 |
| Katolight Corporation | 76 |
| Keasbey & Mattison Company | 61 |
| Kelly-Creswell Co. | 128 |
| Kamine-Sanderson Engineering Corp. | 144 |

| | |
|-----------------------|-----|
| Link-Belt Co. | 69 |
| Lock Joint Pipe Co. | 149 |
| Ludlow Valve Mfg. Co. | 57 |

| | |
|---------------------------------|---------|
| M & H Valve & Fittings Co. | 150 |
| Master Builders Company | 79 |
| Div. of American-Marietta Co. | |
| McConaughay Mixers, Inc. | 27 |
| Miro-Flex Co., Inc. | 34 |
| Monarch Road Machinery Company | 24 |
| Morton Salt Company | 55 |
| Mueller Co. | 25 & 67 |
| Multiplex Manufacturing Company | 158 |

| | |
|-------------------------------|---------|
| Natco Corp. | 12 & 13 |
| National Clay Pipe Mfrs. Inc. | 16 |
| National Power Rodding Corp. | 46 |

| | |
|-----------------------------|-----|
| O'Brien Manufacturing Corp. | 146 |
| Oliver Corporation | 129 |

| | |
|-----------------------------|---------|
| Pacific Flush Tank Co. | 143 |
| Pacific Mercury | 128 |
| Palmer Filter Equipment Co. | 155 |
| Pennsylvania Drilling Co. | 76 |
| Masonry Drill Division | |
| Permutit Division | 151 |
| Pfautler Permutit Inc. | |
| Pfaff & Kandall | 123 |
| Pomona Terra-Cotta Co. | 12 & 13 |

| | |
|-----------------------------|----------|
| Precision Chemical Pump Co. | 159 |
| Press-Seal Gasket Corp. | 38 |
| Process Engineers, Inc. | 145 |
| Public Works | 70 & 163 |

| | |
|----------------------------------|---------|
| Reed Manufacturing Company | 20 |
| Republic Steel Corporation | 22 & 23 |
| Roberts Filter Mfg. Co. | 160 |
| Rockwell Mfg. Company | 35 |
| Rockwell-Standard Corporation | 82 |
| Transmission & Axle Div.-Detroit | |

| | |
|----------------------------------|-----|
| Sika Chemical Corporation | 122 |
| Skinner Company, M.B. | 71 |
| Smith & Loveless, Inc. | 147 |
| Soiltest Inc. | 138 |
| Solvey Process Division | 62 |
| Sparting Meter Company | 153 |
| Stanco Mfgs. & Sales Inc. | 36 |
| Standard Dry Wall Products, Inc. | 40 |
| Synchro-Start Products Inc. | 24 |

| | |
|----------------------------------|---------|
| Tarrant Manufacturing Co. | 122 |
| Taylor & Co., W. A. | 180 |
| Tennessee Corporation | 160 |
| Texas Vitrified Pipe Co. | 12 & 13 |
| Trickling Filter Floor Institute | 12 & 13 |
| Trojan Division | 161 |
| The Yale & Towne Mfg. Co. | |
| Trojan Mfg. Co. | 163 |

| | |
|----------------------------------|-----|
| U.S. Rubber Reclaiming Co., Inc. | 128 |
|----------------------------------|-----|

| | |
|-------------------------------|----|
| Vermore Manufacturing Company | 42 |
|-------------------------------|----|

| | |
|--------------------------------|------------|
| Wacker Corporation | 158 |
| Wallace & Tiernan Co., Inc. | Back Cover |
| Waukesha Motor Company | 43 |
| Western Machinery Company | 144 |
| Weston Co., L. A. | 147 |
| Wilkinson Products Company | 42 |
| Wyandotte Chemical Corporation | 134 |

| | |
|--------------------------------|-----|
| Yale & Towne Manufacturing Co. | 161 |
|--------------------------------|-----|

CONSULTING ENGINEERS APPEAR ON PAGES 165 to 170

PUBLIC WORKS JOURNAL CORP.

200 So. Broad St., Ridgewood, New Jersey

OFFICERS

W. A. Hardenbergh, President
Lewis C. Morris,
Vice President and Treasurer
Edward B. Rodie, Secretary

BUSINESS DEPARTMENT

Lewis C. Morris, General Manager
I. James Barger, Business Manager
Arthur K. Akers,
Director, Advertising & Research

ADVERTISING OFFICES

Ridgewood, N. J., 200 So. Broad St.
W. S. Morris
Cleveland 10, Ohio, Villa Beach 2,
15445 Lake Shore Blvd.
Burton M. Yost, District Mgr.
Los Angeles 36, Calif.
5478 Wilshire Blvd.
Hugh Hollyday, % Smith & Hollyday
David W. Zander

Chicago 1, Ill., 333 N. Michigan Ave.
Robert J. Shea, Mid-West Sales Mgr.
Philadelphia 10,
1434-36 Land Title Bldg.
Rod Ellis
San Francisco 4, Calif.
22 Battery St.
Bill Smith, % Smith & Hollyday
Kansas City, Mo.
4916 West 64th St., Mission, Kansas
C. H. Stockwell



-Worth Seeing

Even in elevated water tanks there can be something new under the sun. This Horton Spheroidal tank is the first 500,000 gallon structure of a design introduced by Chicago Bridge & Iron Co. in 1958. City of Lewisville, Texas, owner.



"Nice work if you can get it!" An arm chair seated painter 30 feet in air in a versatile Pitman Hydraulic crane with aerial basket. Equipment allows 2 men to complete coating 24 lighting standards a day on Illinois East-West Tollway with ease.



Uncovering a section of cast iron water main laid in 1949 to make San Francisco 68th U.S. city to become a member of the Century Club of the Cast Iron Pipe Research Association are T. F. Wolfe, managing director and Gen. Mgr. Turner.



Center, 9 lb. 5 $\frac{3}{4}$ oz. salmon won by E. B. Rodie, managing editor PUBLIC WORKS (l.) and L. J. Langeness (r.) of Elgin Corp. Both guessed its weight exactly, in contest staged by Gillette Publishing Co. at APWA meeting in Seattle. In rear: Mrs. John Osborne. Mr. & Mrs. Keine of Gillette Publishing Co.



You can all but hear this International TD-24 crawler growl as it tears into the job of dozing stumps and broken cement culverts in Freedom Township, Wis. The TD-24 is owned by Outagamie County Highway Department in Appleton and is used in all phases of county work including road building.

Easy-To-Use!

TAYLOR COMPARATORS

**Let You Make Accurate
Water Analysis Anywhere,
Anytime, in Minutes!**

WATER ANALYZER

tests for fluoride,
pH, chlorine,
color, nitrite,
nitrate,
manganese,
copper,
total iron,
aluminum, etc.



Model L-3 for pH, chlorine tests

Here are compact, portable test sets that give highly accurate determinations yet are so simple to use that tests can be made on-the-spot in only minutes. Data obtained simply by placing treated sample in center tube and moving color standard slide across until sample liquid matches one of the color standards. That's all there is to it. Read values directly from the slide, and you have accurate, dependable data for use in water or sewage plant operations. Model L consists of an Enslow Slide Chlorimeter and 3 or more pH slides, in a wooden carrying case. Also available — Taylor Comparators and Midget Testers for control of swimming pool water.

COLOR STANDARDS GUARANTEED

All Taylor liquid color standards carry an unlimited guarantee against fading. Be sure to use only Taylor reagents and accessories with Taylor Comparators to assure accurate results.

SEE YOUR DEALER for Taylor sets or immediate replacement of supplies. Write direct for FREE HAND-BOOK, "Modern pH and Chlorine Control". Gives theory and application of pH control, illustrates and describes full line.



W. A. TAYLOR AND CO.
7304 YORK RD. • BALTIMORE 4, MD.



Worth Telling!

by Arthur K. Akers

★ **Boyd S. Oberlink** and **J. L. Singleton** have been elected senior vice-presidents, Allis-Chalmers Mfg. Co. Both have long been nationally prominent in the industry.

★ **Charles Kuhn** is appointed sales manager, Dresser Mfg. Division, Bradford, Pa.

★ **Tennessee Corporation**, Atlanta, announces new facilities at Copperhill, Tenn. to give substantially increased production of their "Ferri-Floc."

★ **Hamilton Kent Mfg. Co.**, sewer pipe couplings and acid resistant pipe coating, appoints **H. S. Allen**, vice-president.

★ **Komline-Sanderson Engineering Corp.**, Peapack, N. J. has formed **Komline-Sanderson, Ltd.**, in Brampton, Ontario. **Hugh R. Fielding** will be in charge of their Canadian sales of the full K-S line.

★ **Bernard C. Ball** is new advertising and sales promotion manager, White Diesel Engine Division, The White Motor Co., Springfield, Ohio.

★ **Kirk Usher** is now manager of tubular product sales, Aluminum Co. of America.

★ **John J. Mueller II** is now director of advertising, Enterprise Engine Division, General Metals Corp., San Francisco.

★ **Art Shapiro**, president Ace Pipe Cleaning Inc., Kansas City, was a speaker on pipe cleaning at the recent annual water works operators school at the University of Kentucky.

★ **Process Engineers Division**, The Eimco Corporation, announces two newly-elected vice-presidents, **Jack W. Pratt**, at the Research and Development Center in Palatine, Ill.; and **Berne A. Schepman**, at San Mateo, Calif.

★ A substantial increase in tractor shovel production is involved in the

plant expansion of Yale and Towne's Trojan Division at Batavia, N. Y.

★ Obituaries this month regretfully include **Clifford L. Meanor** of Natco Corp., Pittsburgh.

★ **Robinson Clay Product Co.**, Akron, Ohio, is building six new 40-foot periodic kilns at Pottstown, Pa., where much of the Wedge-Lock Joint clay pipe production is concentrated.

★ **The Chapman Valve Mfg. Co.**, Indian Orchard, Mass., is now a wholly-owned subsidiary of Crane Co., but remains under present management and executive staff.

★ **J. J. Closner** assumes the presidency of The Preload Co., Inc., New York.



Mr. Closner



Mr. Bals

★ **John M. Bals** is new general manager, Aurora Pump Division, The New York Air Brake Co., succeeding **Frank S. Main** retired for health reasons.

★ **Cataphote Corp.**, makers of reflective traffic materials, adds a Canadian plant to their Jackson, Miss., and Toledo, Ohio facilities.

★ **Smith & Loveless**, Lenexa, Kans., announce a new 16mm color film on their factory-built sewage lift stations, for class room and engineering firms uses. Address the company for a loan of it.

★ A fault-finding highway inspector was looking over the new road. The crown was not high enough, the shoulder too steep, the ditches too shallow, and so on. Fed up, the foreman finally asked politely, "Well, how is she for length?"

—*Carolina Highways*

LANDMARKS OF MUNICIPAL PROGRESS...

Modern Water Storage Tanks built by

CBI



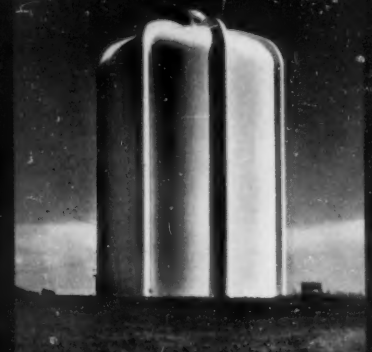
ELLIPSOIDAL
Standard sizes:
15,000 to
500,000 gals.



WATERSPHERE
Standard sizes: 25,000
to 250,000 gals.



RADIAL-CONE
Standard sizes: 500,000
to 3,000,000 gals.



ORNAMENTAL STANDPIPE
No limit to capacity



SPHEROIDAL—Standard sizes: 200,000 to 3,000,000 gals.



WATERSPHEROID
Standard sizes: 250,000
to 500,000 gals.

CHICAGO BRIDGE & IRON COMPANY

332 SOUTH MICHIGAN AVENUE
CHICAGO 4, ILLINOIS



MDCB

OFFICES AND SUBSIDIARIES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

the V-notch

is the difference in chlorine control

Safe chlorine control is the job of a chlorinator. This control, the V-notch, does the job completely. Yet it appears to be simply a grooved plug in a ring. It is, of course, more than that... much more.

The groove in the plug is precision milled and shaped so that when you turn the control knob on your chlorinator and the plug slides through the ring, the size of the opening between the groove and the ring changes an exact amount. You meter chlorine exactly and simply because every position of the plug in the ring makes a repeatable orifice size—a repeatable chlorine flow rate. Only in a W&T V-notch Chlorinator is control so simple, so true, so precisely right.

And, of course, the right plastics make the whole chlorinator chlorine-proof.



A booklet, "The V-notch Story" will tell you about all the W&T V-notch Chlorinator features. For your copy write Dept. S-125-78.



WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

